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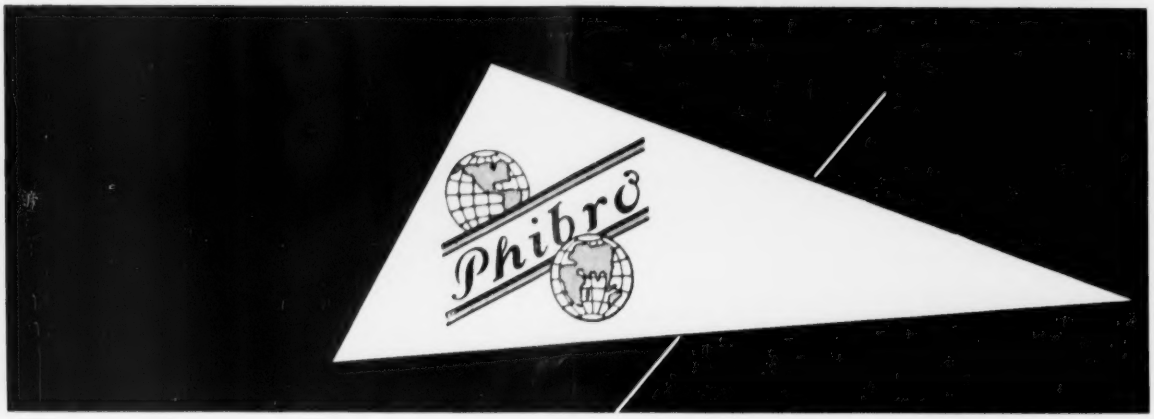

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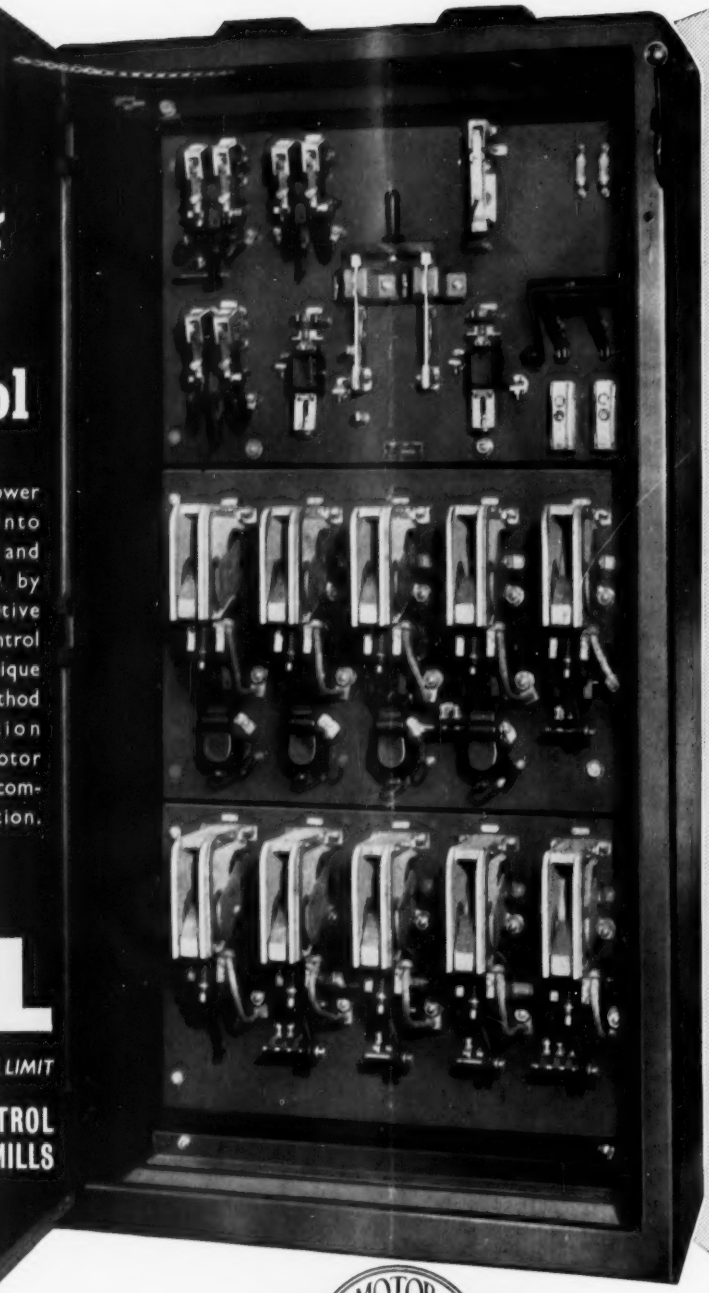

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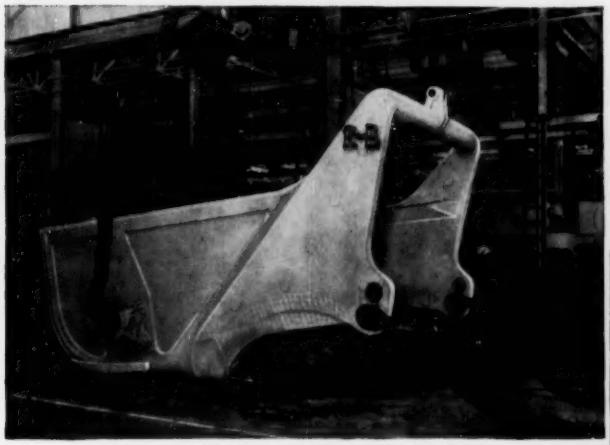

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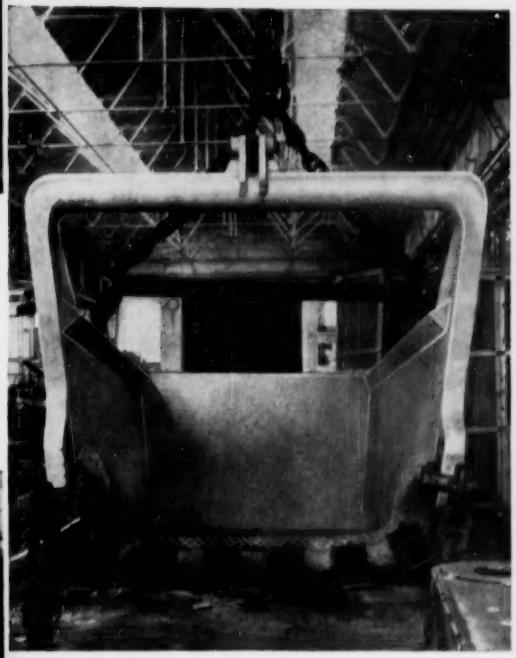

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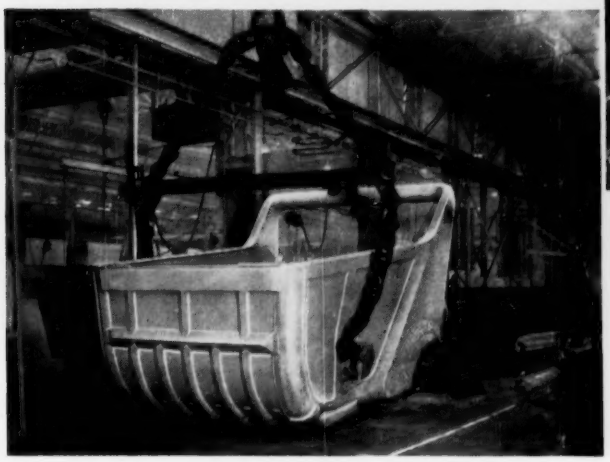

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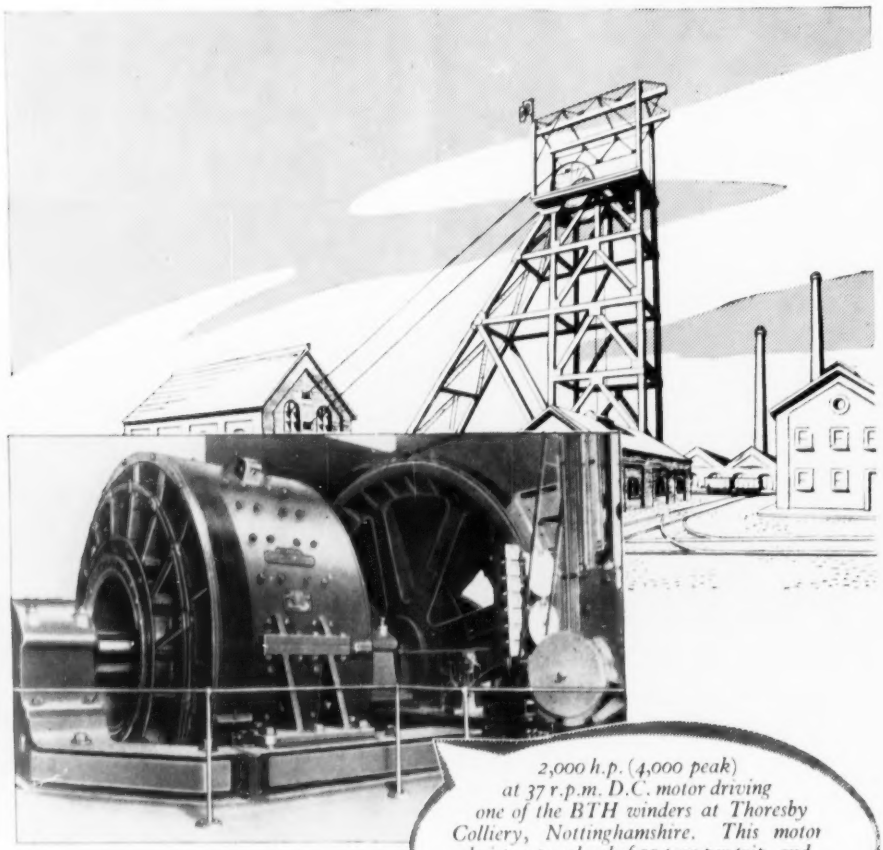

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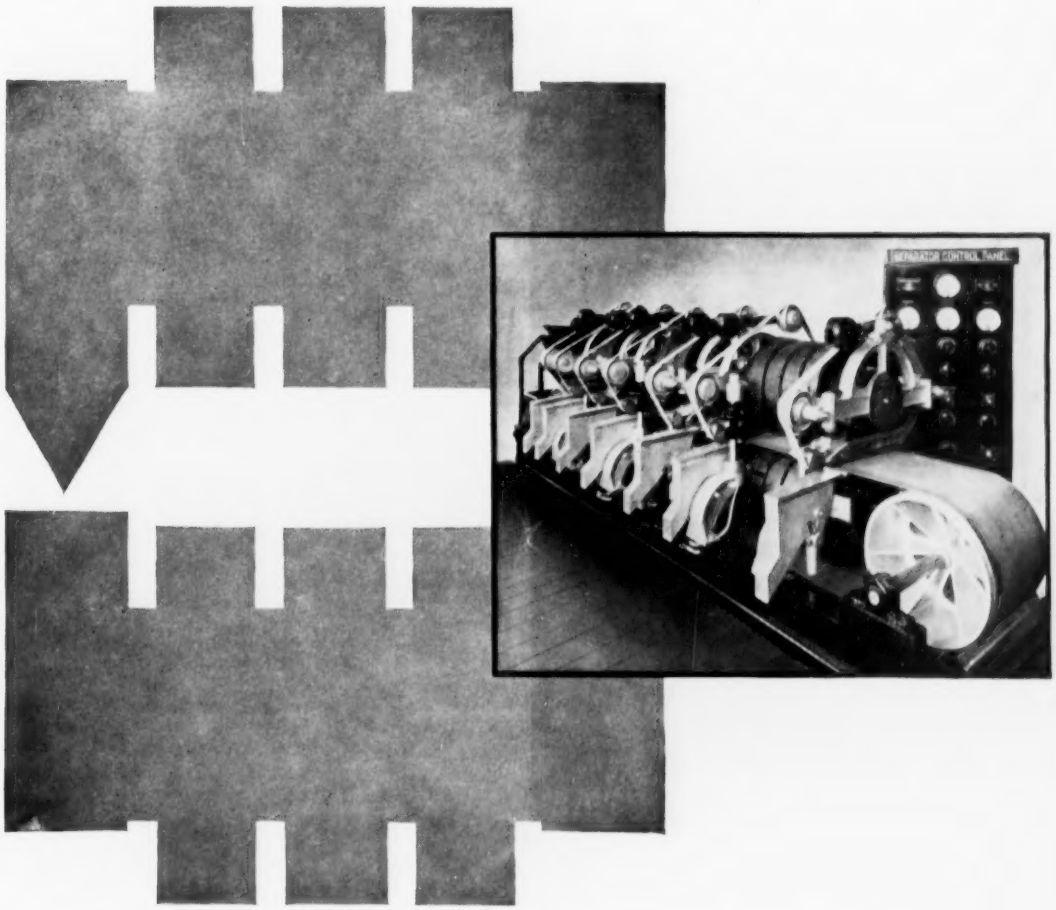

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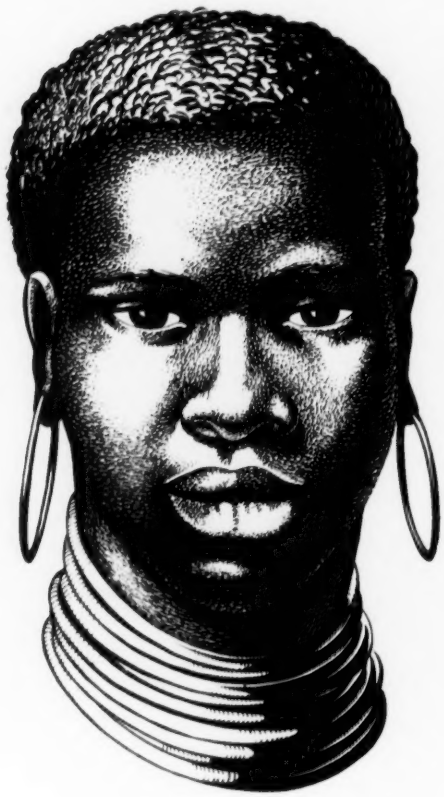

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NOTES AND COMMENTS

Future Role of the Tin Producer in Malaya

The misfortune of copper is that supply and demand have passed into a nice balance while significant producers of the metal are threatened by recurring social unrest. No interruption of supplies can be tolerated and the London Market has reacted sensitively to events in Chile and Northern Rhodesia.

Tin has been spared this uncertainty. Of Bolivia, Indonesia, Siam, Malaya, Nigeria — none is completely stable, and the tide of national feeling is running strongly in all of them. But technical advances in tin usage have kept the metal in substantial surplus (at least in peacetime) and the danger of dislocation from unrest has been slight. Indeed, in Bolivia there has been a notable falling off in production since the nationalization of the large mines—and the market has been rather relieved by it. There are signs that this phase is now ending. In the first place, tin consumption is growing steadily and is on its way to making good the consequences of the introduction of electrolytic tinning. In the second place, Malaya, the largest producer and the one whose output has increased most rapidly in the recent past, appears to be entering a new period of political uncertainty.

The upsurge of nationalism has affected Malaya and Singapore less than most countries because all but the most extreme nationalists recognized that, until the guerrillas were under control, little progress towards self-government was possible. It is the comparative calm in Malaya that now threatens to bring unrest of a different kind.

In point of fact, the more startling development has taken place in Singapore. In the spring, a new constitution took effect in which 25 of the 32 seats in the Legislative Assembly were elected. Mr. David Marshall's Labour Front won—according to the pundits—an astounding victory and, in association with the Alliance Of The United Malays' National Organization, Malayan Chinese Association and Malay Union, formed a government. He was soon involved in a constitutional crisis which arose out of a request for four additional junior ministers but which turned into a conflict as to the matters on which the Governor must accept the Chief Minister's advice and those on which he could reject it. The dispute was only settled by a visit from the Colonial Secretary, after which it was agreed that where the Governor was required to act after consulting the Chief Minister, he should act only in accordance with the Chief Minister's advice but that the Governor's power to dissolve or prorogue were unaffected. There, for the present, the matter uneasily rests.

Meanwhile, in Malaya development has been carried forward from 1948 when the governmental apparatus which has been called "the joint design of Heath Robinson and W. S. Gilbert after a dinner at the Savage Club" was launched. A Federal Legislature with an elected majority now exists and in the recent election for it the result—as astounding in its own way as that in Singapore—has been to give a complete sweep to the Alliance Of The United Malays' National Organization, The Malayan Chinese Association, and the Malayan Indian Congress, which has 47 of the 48 seats. Dato Sir Onn's Negara party won none and Dato Sir Onn was himself defeated. Tengku Abdul Rahman, leader of the Alliance, has called this "a vote for independence and nothing else" and in an important sense he is right for the call for independence is the only thing that holds the alliance together and therefore the only specific point it could properly put to the electorate.

In both Malaya and Singapore therefore the political outlook has changed enormously in the past year. Mr. Marshall, when he comes to London to discuss the Singapore Constitution next spring, will demand immediately self-government; he has said so. The Constitution will then have run for a year, although it was intended to run for four and the speaker was originally appointed for that period. Similarly, Tengku Abdul Rahman, who was once content with demanding independence by 1959 has now advanced his date—no doubt considerably but, as yet, not specifically.

What has happened is that the classical British programme of steady development towards self-government has been jettisoned and it looks as though it may be impossible to rescue it. In this modern world it is scarcely practicable. Once a people has been set on the path of

self-government it is extremely difficult to contain the pace of progress towards it. The Gold Coast is proof of that; in a quite different way Morocco proves the same thing. Mr. David Marshall and Tengku Abdul Rahman cannot demand less than immediate self-government and successfully fight the communists and other extremists. But what will happen when self-government or independence is achieved? It seems only too likely that the parties and races, deprived of their single unifying demand, may fall apart.

Even now there have been 136 strikes in Singapore in the first six months of the year. In Malaya, the racial fears and ambitions of Malays, Indians, Chinese and Europeans are only just papered over; in addition there are the subtler differences between English-Chinese and Chinese-Chinese; and to cap all there are the state rulers to be fitted into a constitution for an independent Malaya. As a background there is a country excessively dependent on a production of two raw materials neither of them completely stable.

It is not necessary to take the gloomiest view of Malaya's future to see in all this a danger for the tin industry. Social and constitutional upheaval may disrupt production or exports of tin. There is the possibility that an independent Malayan Government may want to nationalize, or closely control, the country's basic industries; and there is another danger that nationalization — at least of the Chinese Mines—may follow from interacial conflict. Much will depend on how Mr. Lennox-Boyd has handled the delicate discussions he has been having in past weeks with political leaders and on the preparations for fresh constitutions.

For the tin industry itself, this is not a time for faint hearts. Politically conscious citizens of all races must be taught the full nature of the contribution the tin industry makes to their wellbeing and the importance of creating the conditions in which it can thrive in competition with other producers and other materials. Tin producers must now look to their public relations. There is no denying that Malayan independence is coming, and coming fairly quickly; there is no denying that its coming is likely to be disturbing and possibly tempestuous; but if tin producers can foresee the shape of the new Malaya and come to terms with it, it need not be disastrous.

Shortage of Coal—A European Problem

The inability of the National Coal Board to raise the production of coal in the United Kingdom—total output up to the end of last week at 141,088,500 tons shows a loss of 3,555,600 tons against the 144,644,100 tons produced during the comparable period of 1954—leaves little doubt that poor morale and indiscipline are prime factors affecting the situation. While it is true that output of open-cast coal has risen this year from 278,800 tons during the week ended August 20 to 282,700 tons in the following week—it is impossible to shelter behind inclement weather this year—the fact remains that output of deep mined coal at 133,989,600 tons for the first 34 weeks of 1955 compares unfavourably with the 137,724,300 tons produced from below surface during the same period last year.

There is little doubt that poor morale and discipline are the root causes of the decline. Despite technical advances it is still the attitude of the individual miner which is the major obstacle to higher production. Unfortunately, discipline and morale in the pits are inversely proportional to the need for coal. The more the miners feel themselves indispensible the less amenable are they to a reasonable measure of industrial discipline. Thus, paradoxically, the coal shortage cannot be ended until it no longer exists, for productivity will not materially increase whilst coal shortage continues.

It is, of course, to the advantage of the miner to remain at a premium for scarcity value is the best bargaining tool he possesses. This no doubt explains the reluctance of the British miner to allow 10,000 Italian workers to be employed in U.K. collieries. These Italians could make a substantial contribution to Britain's continually decreasing mining labour force.

The only hope of stimulating coal production would appear to be stiff competition from alternative fuels, but unfortunately competition on such a scale is too distant to have any effect for many years to come. Higher wages and exhortations have not in the past had the desired effect, but, nevertheless, Britain must continue to rely upon the commonsense and innate loyalty of the more far-seeing section of the mining community.

Elsewhere in Europe shortage of coal is giving rise to some concern and the present trend of tightness in the European coal market is expected to be prolonged and even intensified in certain respects in the July-September quarter, according to the Economic Commission for Europe.

A detailed review of the situation shows that on the basis of present plans coke output will fall short of requirements by about 500,000 tons during the quarter. The amount is evenly divided between oven coke and gas coke, and the shortages appear to arise with respect to importing countries, being concentrated on non-members of the European Coal and Steel community.

A further indication of the extent of solid fuel shortage in Europe is suggested by the level of imports by European countries of American coal. European countries (not including Yugoslavia) imported 1,614,000 tonnes of coal from the U.S. in May 1955, compared with 712,000 tons in May 1954. The level of solid fuel imports for these countries from America in the period June 1954 — May 1955 was 11,934,000 tons, against 6,940,000 tons during the same period the previous year.

The heavy demand for coke arises primarily from the continuing increase in requirements for the iron and steel industry, which has made tremendous strides forward since the inception of the common pool. Taking the industry as a whole the production index has risen by 12.4 per cent since 1953, compared to a rise of 6.6 per cent in Britain and 9.4 per cent in the U.S.

Norway

(From Our Own Correspondent)

Mo i Rana, August 8.

The Norwegian State Mine Inspectors have now published their Reports for the year 1954 in which are given the official figures of Norway's ore production last year.

Thirteen base metal mines produced 795,946 tonnes of cupreous and non-cupreous pyrite, 27,375 tonnes of copper concentrates, 12,082 tonnes of zinc concentrates and 1,124 tonnes of lead concentrates.

Seven iron ore mining companies yielded 1,094,523 tonnes of iron ore and concentrates and 149,185 tonnes of ilmenite concentrates. Two mines yielded 265 tonnes of molybdenite while graphite production from one company amounted to 3,622 tonnes. Columbite production from the country's lone producer yielded 178 tonnes of 50 per cent Nb-Ta concentrates and the State silver mine of Kongsberg, delivered 10,477 tonnes of silver ore to the mill and smelter.

Operations Research in Mining Practice

The use of Operations Research as a powerful aid to mental processes is as yet incompletely understood in the mining industry. Yet the accelerating need to solve the intricate problems arising from advances in scientific mining practice demands the assistance that the new study can give. The following article by T. M. Ware, vice-president of the Engineering Division, International Minerals and Chemical Corporation, United States, presents a synopsis of the use and value of Operations Research. The article is condensed from a paper presented at the Centenary Congress of the Société de l'Industrie Minéral, held in Paris during June, 1955.

The new technique of Operations Research is destined to become a part of management's planning and thinking in the mine of tomorrow. But like any new tool it must be thoroughly understood if it is to be useful.

As the original high grade ore discoveries became depleted, subsequent ore finds became progressively more elusive. To improve volume and yields, the technology of mine machinery development is being exploited to a point at which these machines are gigantic, unbelievably complex, and costly. Advances in technology are nowhere more fascinatingly challenging as we seek to find new mineral reserves and to maintain standards of yield and quality upon which the end product depends. Productivity is steadily increasing. An important concept in this direction is to make the most effective use of the higher-order capabilities of man and thereby optimize man-machine system performance.

A FRESH PERSPECTIVE

The basic contribution of Operations Research, is that of providing a fresh perspective. Operations Research is a quantitative methodology. These values are placed with such accuracy and understanding of the whole that we have a clearer picture of the relationship than we have ever had before.

Operations Research analyze relationships and produce a model. This mode, or formula, is an exemplification of a process or system. This model may exemplify a dragline method and its economics of operation. It may represent a total business where the optimum objective is sought.

The mining engineer has placed at his disposal relationships that he never could manipulate before, except perhaps on the slim basis of intuition. Operations Research is his window into the future. It is typical of Operations Research work that the discoveries seem so logical that it is hard to see how they could have been missed. Here are some practical applications and a few descriptions of opportunities for this new decision-supporting tool.

APPLICATION TO DRAGLINE OPERATION

First, I should like to describe the general outline of a dragline operations problem at international Minerals and Chemical Corporation's phosphate mines, United States. The draglines cost about $1,000,000 each, and one is operating at each of three mines in the area, the latest being a 1,500-ton unit with a 235-foot boom reach, and a bucket of 26 cu. yd. capacity. The overall operations handle 28,000,000 cu. yd. of overburden and matrix each year. The draglines not only dig but as they produce, they build the overburden into ridge forms permitting the circulation of waste water from the plant so that we may improve and re-use it.

When it was decided to conduct an Operations Research investigation to optimize the draglines' performance, three sizable responsibilities were visualized. First, maximum utilization of capital invested in the machine; second, supplying the plant at a predictable rate, uniformly and with attention to quality; third, successful recovery of our ore reserves which are literally dug by one man.

It was found that there were many factors in dragline operation. Above all, a mathematical model showed us that the dragline operating methods comprise a rigid system, and one factor could not be changed without affecting another. The essence of the work shows 10 factors to be vital. These include not only the angles of swing and the length of walk, but also considerations for thickness of matrix and overburden, time of performance for each element, relationship of the position of our hydraulic sump for receiving the matrix, position of the spoil pile for overburden, width of the cut to be made, position of the machine with respect to the cut. Many limiting circumstances were established, some established by the characteristics of the machine such as the boom length and the rates of swing, and others established by the nature of the task such as the mechanics of the soil structure and the angles of soil repose.

A formula was created that did not look like very much more than theory. Set up in a high-speed digital computer, which performed the equivalent of over 300 man-years of computation, the model delivered immensely practical results.

Following the example of the chemical processing industry, in the future mine-mill management will place more emphasis on progress economics. Through Operations Research analysis, it will expose how one department of a plant may minimize its costs and maximize its profit at the expense of another portion of the plant in subtle ways that have not been recognized before.

MINING APPLICATIONS

Operations Research methods can take a lot of the guesswork out of both proving an ore reserve and planning the mine layout for optimum performance. It can provide an excellent opportunity to complement the work of the exploration and mining engineers at relatively little cost. Again, the relationship of known data to decision opportunities can be clarified in ways that have not been familiar before.

Consider, for instance, the proving-out of ore reserves for grade and tonnage. The mathematical probability of success for any given amount of exploration drilling can be established. The hit-or-miss grid technique may be redefined in specific arrangement, or alternatively a "factor of confidence" can be placed on the drilling that has been carried out using empirical technique. The number of holes required for a given accuracy of definition of the ore body can be determined, too.

When all that can be learned about the deep mining type ore reserve has been determined with a high degree of reliability, the Operations Research technique offers still more benefits to the mining engineer in mine planning. Here it will be possible to synthesize mine development and operation to realize lowest cost operating layouts.

It may be that the long established empirical design relationships that exist in blasting can yield to Operations Research analysis for improved efficiency and effectiveness. Certainly the shaft can be located with better predictability of ore grades, and the costs and values of shaft design features can be established well ahead of time.

Open Pit Taconite Mining at Mesabi, United States

By JOHN GRINDROD

Although much of the high-grade iron ore is yet to be mined from the Mesabi Range in the Minnesota-Wisconsin-Michigan area of the United States, the supply is dwindling fairly rapidly and the point of exhaustion of the deposit may be foreseen. To help forestall the effect of this decreasing supply of high-grade iron ore, important developments have taken place in the economic winning and processing of taconite, the mother rock from which the high-grade ores are formed by natural processes. Approximately 95 per cent of the Mesabi Range consists of taconite, and the following article describes the methods evolved whereby taconite can be processed to the desired high-grade product.

Mined by open pit methods and despatched to the steel mills as it comes out of the ground, the Mesabi high-grade ore contains approximately 50 per cent iron and 50 per cent impurities, which are then removed. Taconite, on the other hand, named after the Taconite Hills in New England, whose rock grain structure closely resembles that of the Mesabi, contains only 20 to 30 per cent iron in the form of oxides, mixed with 70 to 80 per cent impurities, in the form of iron carbonates, iron silicates and quartz.

A factor recently attracting the industry's attention has been the iron oxides. These oxides, to avoid unwarranted expense in despatching unusable waste and to make the taconite economically acceptable to the steel mills, must be processed before being loaded aboard the Great Lakes ore ships. After concentration the average taconite will contain 60 to 65 per cent iron, compared with the 50 to 52 per cent of the richer ores.

OPERATING COMPANY

Undertaking the open pit mining and processing of the taconite on the Mesabi is the Reserve Mining Company, organized as a Minnesota corporation more than a decade ago, and owned jointly by Armco Steel Corporation and Republic Steel Corporation. Re-equipping an old inactive taconite processing plant at Babbitt, Minnesota, with the latest machinery, the company have also had constructed

A jet piercing machine in operation at Babbitt

The taconite mine at Babbitt, Minnesota

for them a new E. W. Davis concentration plant at Silver Bay on Lake Superior, named after Prof. E. W. Davis, head of the University of Minnesota's Mines Experiment Station and a leading authority and exponent on the development of taconite rock.

The taconite on the Mesabi Range is of the magnetic variety, and exists in layers of rock just below the surface in a vast deposit on the eastern tip of the range in St. Louis County. This deposit is about 9 miles long, averages 2,800 ft. width and, wedge-shaped in cross-section, is 175 ft. deep at the thickest point. It is virtually free of glacial overburden and outcroppings of taconite are frequent.

The ore body is known to contain at least 1,500,000,000 tons of magnetic taconite which can be mined by open pit methods. This quantity, when processed, will amount to 500,000,000 tons of high-grade ore, enough to supply 10,000,000 tons annually for the next 50 years. In addition to proven deposits, geological studies indicate the presence of substantial additional tonnages of taconite on the property. Mining operations began in August, 1952, and the initial cut in Reserve's mine is more than 6,000 ft. long. Approximately 1,350,000 tons had been removed in the first two years' working.

MINING METHODS

After the overburden has been removed with the same equipment as that used for the mining of taconite, the exposed rock is prepared for blasting. This is being performed by the newly-developed jet piercing machines, which literally burn 40-ft. deep holes into the rock. Burning oxygen and kerosene, these machines create a flame of fantastically high temperatures—about 4,300 deg. F.—which pierces the hole at an average speed of 18 ft. per hour. Sprays of water quench and embrittle the particles of rock exposed to the flame and help to carry them away. Weighing 77,000 lb., the jet piercing machine has a 50-ft. derrick. The ejected particles are small, half of them being paper-thin and less than $\frac{1}{16}$ in. in size.

Following drilling, mining explosives, prepared in cartridges which may weigh up to 80 lb., are placed in the holes and these may be detonated by means of caps, blasting fuses, special primers or boosters, or by electricity. Very safe to handle, the explosives include desensitized nitroglycerin, which requires a special agent to make it active, and non-freezing dynamite. The latter is a useful explosive in this area, since taconite mining goes on all the year round and much blasting is done in winter, when frozen dynamite would be unsafe and the process of thawing it out dangerous.

In its solid form in the earth taconite weighs 220 lb. per cu. ft., and in its loose form after blasting, 133 lb. per cu. ft. In this state it is loaded by the dippers of giant

Top view of the 62 in. coarse crusher of the E. W. Davis works near the Babbitt mine

power shovels into dump trucks each capable of carrying from 30 to 50 tons of rock. Most of the shovels have a bite of 5 cu. yd., or 9 tons weight.

TREATMENT PLANT

The trucks haul the crude taconite from the mine to the primary crusher over one to several miles of well-kept roads. Recently installed at Babbitt is the world's largest gyratory crusher, manufactured by Allis-Chalmers Manufacturing Company, and this, along with several smaller units, carries out the initial crushing. Housed in an 80-ft. wide pit sunk in solid granite near the mining area to a depth of 170 ft., for which more than 20,000 cu. yd. of rock had to be removed, this largest gyratory crusher took two years to build and is placed so that its top is slightly below road level. The trucks then back up to the opening and dump their load directly into the open top of the crusher. This receiving opening, which is the distance from the centre of the crusher to the inner surface of the outer shell, has a width of 5 ft. and utilizes a 109 in. maximum diameter crushing cone. It is capable of crushing over 3,500 tons of taconite an hour, from pieces as large as 5 ft. on one dimension down to 10 in. in size.

Mounted in the centre of the crusher shell, the crushing cone is shaped like a pharmacist's pestal with the wide section at the bottom of the shell. Two 500 h.p. motors drive the cone in an eccentric motion, which alternately increases and decreases the space between the tapered surface of the cone and the comparatively straight surface of the shell. When the space increases, any rock present at the time will slip down into the larger space. On the next cycle, when the cone moves in to decrease the gap, it finds the rock in the way, crushes it and continues on its eccentric path in the shell.

The main shaft of the crusher is a steel forging approximately 27 ft. long and has a maximum diameter of 4½ ft. and weighs 205,000 lb. Four other major steel castings were required in its construction and, with a total weight of 822,300 lb., these weighed individually from 180,000 lb., for the lower part of the top shell, to 251,500 lb. for the bottom shell.

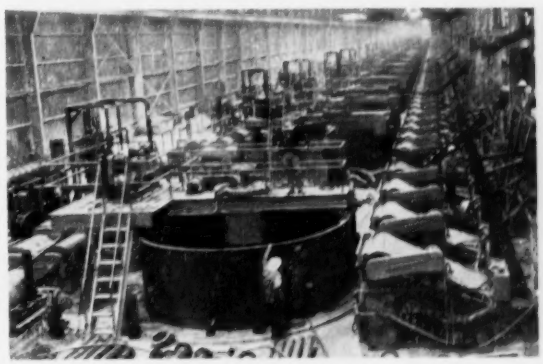
After dropping out of the bottom of the primary crusher, the rock passes into the open cavity of the secondary crusher, which duplicates the action of the primary crusher, differing only in size. As it drops out of the secondary crusher, the rock is reduced to less than 4 in. pieces. The total time taken to reduce a rock as large as 1 cu. yd. down to less than 4 in. may be less than 1 minute, and many such huge rocks may be going through the primary and secondary crushers at the same time.

At this first-size stage the taconite is despatched by special railway to the processing plant at Silver Bay, where tertiary and quadarary stages of crushing cause the rock to emerge no larger than ¼ in. in size. Both of these are cone crushers, much smaller than the first two.

Diesel electric locomotives haul the 110-car trains of lump taconite on the 47 miles journey between Babbitt and Silver Bay. Each car has a capacity of 87½ gross tons, giving a rail load of 251,000 lb. Equipped with swivel couplings the cars are dumped, a car at a time, without being detached from one another. From Babbitt, the railway climbs 188 ft. in the first 30 miles, then drops 927 ft. in the last 17 miles. The maximum grade for the eastbound loaded trains is 0.5 per cent and for westbound empty trains 1.5 per cent. The line crosses four rivers, one road, another railway and has over 14,000 ft. of culverts ranging from 24 in. to 84 in. in diameter. During construction of the railway, which required the equivalent of 5,600 carloads of material, more than 2,000,000 cu. yds. of road excavation and 1,500,000 cu. ft. of granular borrow were required. Muskeg swamps encountered varied in size up to 3,000 ft. long and 27 ft. deep.

MILLING CAPACITY

Because the iron in the taconite is present in very small particles, the ¼ in. size rock must be further reduced, first in rod mills and then in ball mills. After being mixed with water the ¼ in. rock pieces are broken down to the size of coarse sand, or 8 to 14 mesh, by the tumbling action of the rods inside the rotating mills, which operate at about 15 revolutions per minute at a power of upwards of 800 h.p. The rod mills are capable of dealing with over 120 tons of taconite an hour.



The lower level of the concentrator building at the E. W. Davis works showing on left hydroseparators and on right magnetic separators. Rod and ball mills are situated on higher levels of the same building

On being discharged from the rod mill the taconite is small enough to go through the first stage of magnetic separation of the iron from the waste, or tailings, which at this point, consist mostly of silica, and which make up about 30 per cent of the material.

Following its first screening the magnetic taconite then passes through the ball mill circuit, whence it emerges as fine as 325 mesh and passes through a further series of magnetic separators which remove most of the remaining unwanted waste. At this point the iron minerals are concentrated to over 60 per cent iron.

Since the concentrate is still water-soaked it then passes through filters which suck out the excess water leaving a black cake rich in iron and of a fineness similar to cement.

How to get this concentrate ore into the blast furnaces then became the next problem in developing the taconite processing chain, since the strong up-draughts present in the blast furnace would carry the fine particles of taconite away from the furnace instead of into it.

Several methods of making the powdered iron ore acceptable to the blast furnaces have been developed and have been tried in experimental pilot plants. These include nodulising in a rotary kiln, where the concentrated iron oxides are burned into nodules which are heavy enough to overcome the up-draught of the blast furnaces; sintering which literally burns a large continuous bed of iron oxide into one mass and then breaks it into chunks which are heavy enough to overcome the up-draught; and finally, pelletising. where the iron ore concentrate is rolled into definite sized balls of sufficient weight and then burned to make them hard enough to resist breakage in transit to the furnaces.

Of these three methods the pelletising process, pioneered at the Allis-Chalmers works, appeared to be most promising and has been adopted at the Silver Bay and Babbitt plants of the Reserve Mining Company. By mid-1954, the Babbitt plant had produced some 340,000 tons of pellets and further commercial size plants are scheduled which will produce 12,000 tons of pellets per day when completed. The cost of the Babbitt-Silver Bay Taconite project will be in the region of $190,000,000.

The World-Wide Steel Boom

(From Our Iron and Steel Correspondent)

The continuing pressure of demand suggests that the steel boom has not yet reached its zenith : it is moreover world-wide in its incidence. In the United States which is by far the world's biggest producer the upsurge of demand has surpassed all expectations; order books are overloaded, a rise of 25 per cent on the volume of exports is indicated, and present calculations are that the aggregate ingot output for 1955 will exceed the previous record of 111,600,000 tons in 1953. At the beginning of this year steel industry predictions ranged from 95,000,000 to 100,000,000 tons but periodically the sights have since been raised and there is now a growing belief that the fourth quarter will be the busiest ever.

Canada reports a serious steel shortage which is delaying important constructional contracts, but the most striving manifestations of the boom are provided by Western Germany. Battered and shattered by the Allied attacks during the war period, the German steel industry suffered further severe losses when many of the plants were bodily dismantled by the victors in the early post-war years.

THE INDUSTRY IN EUROPE

But phoenix like, a new and rehabilitated steel industry has arisen from the ashes. In the first six months of this year an ingot output of 10,300,000 tons approximately equalled that of the U.K. and it is confidently expected by industrial leaders that the total production this year will reach 21,000,000 tons, a figure which will advance the Federal Republic to the rank of the third largest producer in the world, with Britain relegated to fourth place. This achievement becomes all the more impressive when it is remembered that as recently as 1949 German steel production was little more than 9,000,000 tons.

The French steel industry is also rapidly scaling new heights of prosperity. During the first six months of this year 6,350,000 tonnes of crude steel were produced, an increase of 26 per cent over the corresponding period of 1954, and it is expected that the aggregate output for the year will be 12,500,000 tonnes to which the Saar will contribute a further 3,000,000 tons.

This spectacular increase in production which has enabled France to meet the heavy demands of home and foreign buyers, has only been made possible by the steady development of the programme of economic expansion launched after the second world war.

The first modernization plan completed about 18 months ago involved an investment of Frs.335,000,000, and a further sum of Frs.360,000,000 has been allocated to cover the cost of the second development plan now in progress which is designed to raise the capacity of the French-Saar works to 18,000,000 tonnes per annum.

Since the establishment by the European Coal and Steel Community of " a common market," the steel exports from France to Germany have been trebled, and the High Authority at Luxembourg has been emboldened to forecast a leap from the current output of 51,000,000 tonnes in the six affiliated countries to between 57,000,000 and 58,000,000 tonnes by the beginning of 1958.

Accomplishment of this aim will involve the expansion of pig iron production from 33,000,000 to 41,000,000 tons and, of course, a corresponding increase of 25 per cent in iron ore consumption.

INCREASED U.K. PRODUCTION

In an era of unprecedented expansion the problem of providing the enormously increased tonnages of raw materials is common throughout all the principal iron and steel producing centres. In this country the actual imports of iron ore fell to 5,860,000 tons during the first six months of this year compared with 6,080,000 tons in the first half of 1954, and the deputy chairman of Colvilles uttered a warning that a shut-down of plant in Scotland would be inevitable this winter unless depleted stores of ore could be replenished.

A dispassionate examination of the facts leads to the conclusion that Sir Andrew McCance may have been unduly pessimistic. Prior to the rail and dock strikes lower ore production was running at a higher rate than last year. These two strikes were also a partial cause of the shrinkage of imports and a further restrictive factor has been the diversion of ore carriers to the transport of coal.

There is, however, no lack of ore supplies and the transport position has improved considerably. B.I.S.C. (Ore),

which is responsible for all British imports of iron ore has hired 12 converted oil tankers of 12,000 to 15,000 tons capacity on time charter. In other directions more steamer tonnage has become available and there has already been a considerable improvement in the arrivals of foreign ore. July, in fact, was a record month. Compared with an aggregate of 5,860,000 tons in the first six months of this year 1,163,000 tons were imported in July : the August figure is expected to reach 1,200,000 tons and 1,300,000 tons in September. Thereafter there is bound to be a decline, as some of the ore ports close down for the winter, but the situation is much more hopeful than it was a few weeks ago and it is now generally believed that stocks in hand and supplies in sight, will enable new plant to be brought into operation according to schedule.

This is a matter of vital interest to all the metal-using industries of Great Britain. The dearth of supplies of iron and steel is serious. Constructional work is delayed because the steel makers have fallen so far into arrears with their deliveries. Crude steel output for the year is expected to reach the record figure of 19,500,000 tons, but it is not nearly enough. Imports which totalled no more than 470,000 tons last year are now running at the rate of 1,600,000 tons per annum and overseas sales are being voluntarily restricted by the makers to liberate more material for home use

THE STEEL SHORTAGE

Perhaps it is not surprising that there have been recriminations. It has even been suggested that the British steel makers have been too short sighted in the preparation and prosecution of their development plans. It is easy to be wise after the event. Neither in this country nor abroad was the extent of the world demand foreseen. But production in the fourth quarter of this year promises to establish a new record. More new plant will shortly be coming into production. Four new blast furnaces at Barrow, Ebbw Vale, Shotton and Margam with an annual pig iron capacity of 1,000,000 tons will soon be operating.

Relief can only be gradual. Potential outputs to the end of the year are fully sold and makers are now indicating delivery dates as far ahead as April 1956. But there are substantial grounds for hope that the congestion will be relieved and in the meantime deficiencies in the domestic output are being made good by further purchases of foreign material. Contracts have already been placed for increased imports of pig iron, and despite the growing scarcity of scrap, orders have been placed for scrap imports at about the same rate as in the first half of this year. Very substantial tonnages of crude and finished steel (principally in the form of flat steel products) are being imported from the U.S. and the purchase of 8,000 tons of billets of Japanese manufacture is also announced.

Overseas developments include the placing of a contract by the Turkish Government with Krupps of Germany for the construction of a 600,000 ton steel plant at Karabuk on the Black Sea, and the second five year plan for the expansion of Indian iron and steel capacity from 1,585,000 tons to about double that amount. This is in addition to the target of 3,000,000 tons to be purchased in the State owned sector of the industry.

In the realm of scientific and technical advancement the British Iron and Steel Research Association is doing most valuable work, and one of its latest achievements is not the least notable. It transpires that the Mechanical Working Division of B.I.S.R.A. has developed a method by which the liquid residues resulting from the process of pickling steel for the removal of mill scale and rust can be turned to commercial use by the extraction of the iron sulphate. In a pilot plant, the iron sulphate has been successfully converted into iron oxide and fresh sulphuric acid.

TECHNICAL BRIEFS

The Flotation of Beryl

A method of treatment of low-grade beryl deposits has recently been developed by S. M. Runke, of the United States Bureau of Mines (Rept. Invest. No. 5067). Beryl-containing pegmatitic material is first of all crushed to −20 mesh and then wet ground to −35 mesh or finer. Desliming is carried out by agitating with water and decanting, after which muscovite is removed from the deslimed sand by flotation. This is done by first conditioning the sand for about 3 minutes with up to 5lb. of sulphuric acid, 0.05—0.15 of an alkylamine salt collector such as tallow amine acetate, and 0.01 lb. of a frother such as methyl amyl alcohol per ton of feed. Conditioning is carried out at a pulp density of about 50 per cent solids and the muscovite is floated after dilution to 25 per cent solids.

Beryl and feldspar are together floated from the tailings after conditioning for between 2 and 4 minutes with up to 4 lb. of hydrofluoric acid per ton and similar amounts and types of collector and frother as used in the previous stage. The beryl is separated from the beryl-feldspar concentrate by conditioning with 0.5—2 lb. of calcium hypochlorite per ton for less than 5 minutes, at a pulp density of about 50 per cent solids, followed by washing to remove all reagents and a further conditioning with 1-4 lb. of sulphuric acid and 0.5-3 lb. petroleum sulphonate for 2-3 minutes. The beryl is floated from the feldspar after dilution to about 25 per cent solids.

Using this technique, ore containing 0.25 per cent beryl yielded a product containing 66.5 per cent beryl with a recovery of 74.1 per cent of the total beryl present. An ore containing 10.1 per cent beryl yielded a concentrate containing 97.4 per cent beryl with a recovery of 82 per cent.

Applications of Zirconium

According to McClain and Nelson (U.S. Bur. Mines, Inform. Circ. No. 7686) zirconium has been shown to be a serious competitor to Hastelloy in situations where resistance to attack by hydrochloric acid is of importance. Further, it has excellent resistance to many other corrosive agents such as sulphuric acid and fused caustic alkali. It has a very important laboratory use in the production of crucibles which will stand a minimum of 25 fusions whereas iron crucibles will only withstand up to five fusions.

New Magnesium Sealing Process

I. B. Herr has described a process by means of which the corrosion resistance of magnesium may be increased by between 300 and 400 per cent (Western Metals 12, No. 7, 61, 1954). The magnesium parts to be treated are impregnated with a resin using a vacuum-pressure method. After impregnation, the resin is polymerised in a pressure oven at a temperature of 275 deg. and 100 lb. per sq. in. pressure. Surplus resin left on the surface is stripped off by immersion in alkali so completing the process.

Chromium Coating of Aluminium

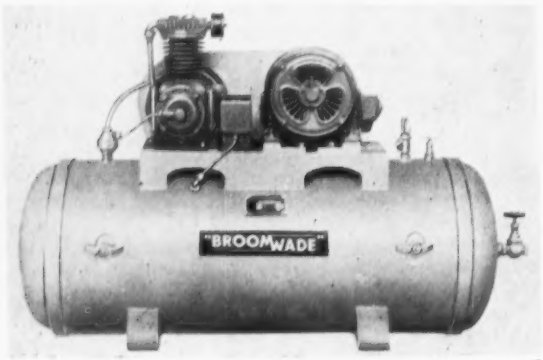
Tiarco Corporation, United States, has announced the introduction of a new process for surface hardening aluminium and all aluminium alloys, according to a report in *American Metal Market*.

Tiarco Corporation points out that this Hardalume process has several advantages for industrial use. Other than eliminating intermediate metals before chromium is finally applied, the new process allows aluminium to form a perfect bond with the chromium.

ENGINEERING, MARINE & WELDING EXHIBITION, 1955

The Engineering, Marine and Welding Exhibition and the Foundry Trades Exhibition is being held from September 1 to September 15, 1955, at Olympia. The exhibition occupies all the halls at Olympia and covers more than 250,000 sq. ft. Over 1,000 products are displayed on more than 500 stands, and some of those equipments having applications within the mining industry are described below.

On Stand 11, Row B, Grand Hall, *Broom and Wade, Ltd.*, are exhibiting portable and stationary air compressors and



The Broom and Wade DCL 15 air compressor

pneumatic tools. Among these units are examples of the new lightweight D.C.L. compressor range as well as a new air-operated hand drill. This drill, designated the Type B.W.D. 120, weighs 7½ lb. and is suitable for rotating drills or non-rotating chisels.

A special exhibit is the new Broomwade portable rotary air compressor, delivering 600 cu. ft. of free air per min. at 100 lb. p.s.i. pressure. The compressor is direct coupled through gear type coupling to a 180 B.H.P., C. 6 S.F.L. Rolls-Royce supercharge diesel engine running at 1,650 r.p.m.

Films will be used on Stand 18, Row A, Grand Hall, to demonstrate dust and fume suppression when the *Dustuctor Co., Ltd.*, makes its first public appearance. The display will interest all concerned with dust suppression—particularly the iron and steel industries—in view of the regulations coming into force in the New Year.

Examples of the Dustuctor L.V.H.V. (low volume-high velocity) system of dust and fume extraction will be shown. In applications so far made this has proved more satisfactory than other systems. Concentrated suction, without the need for air in large volumes, is applied at selected points close to the dust-source. Dust is entrapped and contained before it can escape, thus resulting in a substantial saving in air consumption.

Displays of Dustuctor cowls fitted to Pneumatic and Electric Portable and Bench grinders will show the excellent adaptability of the system. In a special booth, Electric, Radial and Surface Grinders will be demonstrated, and there will be an illumination system showing the efficacy of the system by working tests.

The system will also be shown applied to pneumatic hammers in fettling or other dusty operations. The Dustuctor chisel sleeve of moulded rubber allows dust to be drawn through ports to a dust hose attached at its upper end. An alternative method, the Fettling Glove, with dust-tube attached, is also shown. In the demonstration booth an electric exhauster is demonstrated; the alternative Eductor system can be seen on the stand also.

When dust is collected by these means, the necessary filtering and separation must be carried out. A Dual Cyclone collector and filter, for use with cowled grinders is being shown, as well as other Collector and Filter Units. These can be used with either electric or pneumatic suction equipment. L.V.H.V. methods of fume extraction can be seen on the stand, where a small dustuctor Fume Extraction ring will be arranged on a crucible.

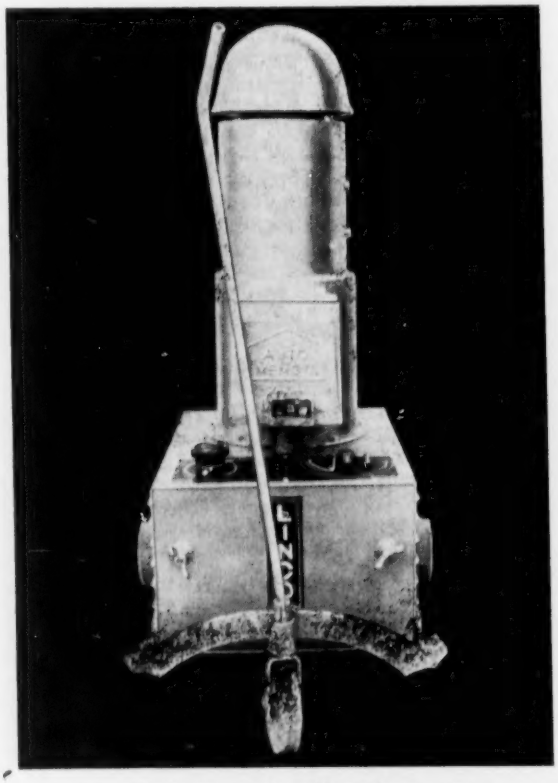
Keith Blackman, Ltd., on Stand 1, Row A, Ground Floor, Grand Hall, are displaying the Keno hydro rotor industrial wet washer for removing finely divided dust particles from air streams as, for example, from grinding, polishing and buffing machines or paint spraying booths. This new development, exhibited for the first time comprises a water tank, rotating helix and squirrel cage, set of eliminator plates and either an axial or centrifugal fan. The Keno wet washer may be supplied in various arrangements to suit the particular application.

On Stand 6, Row C, Grand Hall, *The Consolidated Pneumatic Tool Co., Ltd.*, is providing practical demonstrations of many types of engineering features featuring C.P. portable power tools.

These working exhibits embrace air operated equipment powered by an electrically driven stationary air compressor as well as the Hicycle system. A variety of sizes of impact wrench is on display as well as the new Rotary Portable Air Compressor and a wide range of power tools.

Lincoln Electric Co., Ltd., is exhibiting on Stand 5, Row U, Empire Hall. The exhibits include the shield-arc welder, Type S.A. 150; a unit having a wide range of welding applications. The shield-arc welders are stated to weld practically all metals and alloys and accomplish hard-facing work because they are of the motor generator D.C. type. The Type S.A.150 has a continuous rating of 150 amps, a current range of 20 to 200 amps, and a portable weight of 470 lb.

Other Lincoln welders—with dual continuous control—include the S.A.E. 300 welder powered by the new Perkins L4 diesel engine having an industrial 12-hour rating of 46 b.h.p. at 1,500 r.p.m. In this type of unit the combination of the two controls allows the operator to blanket the entire range of the welder.



The Lincoln Type S.A. 150 shield-arc welder

Stewarts and Lloyds, Ltd., with associated and subsidiary companies, are exhibiting a selected range of their products on Stand 6, Row E, Ground Floor, Grand Hall. The principal display is devoted to boiler tubes, both seamless and electric resistance weld, and manipulated pipework for high pressures and temperatures.

Among other of the company's products, either on show or illustrated by photographs, are various items of shipyard equipment, including sheer legs, tubular steel derricks, davits and masts; steel buttwelding fittings, coils, steel castings, a wide range of joints and couplings, including Victaulic Joints and Viking Johnson Couplings, protective linings and coverings, including glass tissue wrapping, brass and gunmetal valves and fittings; steel tubes for many purposes, including the conveyance of steam, gas, water, oil and sewage. Tubewrights, Limited, a subsidiary of Stewarts and Lloyds, are displaying a series of their products.

On Stand 6, Row N, Ground Floor, National Hall, *The British Thomson-Houston Co., Ltd.*, is exhibiting a wide range of electrical and mechanical plant and equipment for marine and industrial applications. These exhibits include a model of a 5,500-h.p. gas turbine for the Shell tanker "Auris," which is to replace the BTH gas turbo-alternator set and the three diesel-driven alternators now installed, as well as a complete multi-motor control-board for a new tanker. Other equipment on display include marine radar equipment, engine-driven alternator sets for industrial use, and electric motors from fractional horsepower sizes upwards, and control gear, switchgear, and industrial electronic equipment. Mazda lamps and lighting equipment are included in the display.

G. A. Harvey and Co. (London), Ltd., are exhibiting on Stand 7, Row M, National Hall. Various types of specially-designed plant in welded stainless steel, monel, nickel, clad and mild steels are displayed as well as photographs of certain types of petroleum refinery plant for export. The "Harco" range of products is given prominent place as is sheet metalwork.

The English Electric Company, Ltd., is exhibiting on three stands.

On Stand 5, Row Q, Ground Floor, National Hall, the Diesel Engine Division is represented by several exhibits. These include a 400 kW. mobile emergency diesel generating station on wheels; an eight cylinder, pressure-charged marine diesel engine and gearbox for installation in a coasting cargo vessel and a 16 cylinder "Vee" form diesel engine from the "English Electric" SV series—as used in a variety of duties, including industrial, rail traction and marine.

On the same stand the Industrial Motor Department shows a range of British Standard Dimensioned totally-enclosed, fan-cooled motors, Class L.Y. These motors are available in preferred outputs from ½ h.p. up to and including 25 h.p.

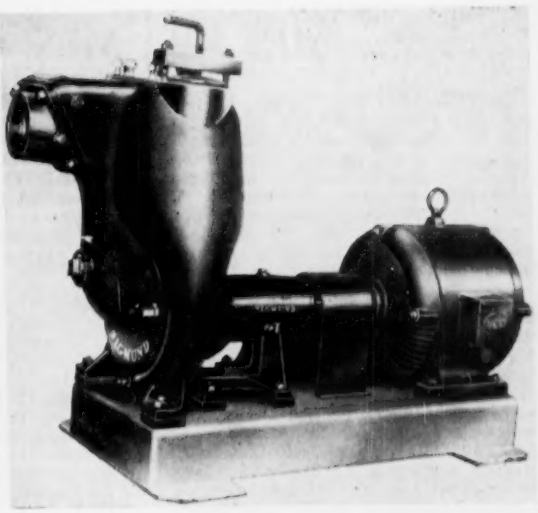
On Stand 4, Row W, Ground Floor, Empire Hall, the Welding Division displays a complete range of portable and multi-operator A.C. welding equipment.

On Stand 10, Row DD, First Floor, Empire Hall, the Industrial Electronics Department shows a 60 kW. R.F. induction heater with a pin and bush hardening machine, a 3 h.p. simplified electronic controller complete with control station and motor and a ½ h.p. "Magamp" speed controlled motor unit complete with control station and motor.

In addition the Traction Department are showing locomotive models.

On Stand 24, Inner Row Gallery, National Hall, *Sigmund Pumps, Ltd.*, display a series of modern units embodying the latest development in centrifugal pump technique. The focal point of the exhibit is the illuminated set piece depicting the unit interchangeability of the Sigmund Norma Pump. By pressing a series of buttons the degree of component interchange on one support frame size, i.e., shaft, sleeve, bearings, gland, impeller nut and locking washer, etc., is shown, and indicates the increased range of duty combinations possible with the consequent reduction to the minimum of spare parts to be carried.

Only four support frames cover the 34 pump sizes in the Norma range, and the same degree of interchangeability is applicable to each frame size. The advantages of this standardization and unit interchangeability is reflected in initial cost, spares supply and replacements.



The Sigmund electrically driven automatic self-priming contractor's pumping set

Recently introduced into the Sigmund range and shown for the first time is the series of self-priming contractors type pumps. Available in sizes from 1½ in. to 8 in. capacities from 2,000 to 100,000 g.p.h. with electric, petrol, and diesel drive, these units set a new standard in pumping performance.

An extensive range of low, medium, and high pressure pumps is also displayed for a wide field of applications in public utility, industrial, and domestic service, each type embodying the most advanced developments in centrifugal pump technique.

On Stands 12 and 14, Row G, Ground Floor, Grand Hall, *Crossley Brothers, Ltd.*, are displaying the Crossley Premier 1,500 b.h.p. horizontal *vis-a-vis* oil engine, suitable for a variety of industrial applications. The engine shown is an 8 cylinder pressure charged unit having an equal number of cylinders disposed on each side of a central crankshaft. The range covers 8, 10, 12 or 16 cylinders and from 1,050 to 2,100 b.h.p. without pressure charging, and from 1,500 to 3,000 b.h.p. with mechanically-driven blower.

Also on exhibition is the 1,380 b.h.p. power unit for diesel electric locomotives, the engine incorporated being an 8 cylinder "Vee" type designated H.S.T. Vee 8 and developing 1,380 b.h.p. at 650 r.p.m.

On Stand 2, Row Q, Ground Floor, National Hall, *Tecalemit, Ltd.*, exhibits a new centralized lubrication system. This new equipment incorporates a hand or power-operated pump which charges a series of injectors which, in turn, service a series of individual points. The injectors are of simple but robust design and entirely dispense with the use of springs, cup leathers or ball valves which, so often can be sources of trouble in this type of system. The actual injection of the lubricant is accomplished by a two-stroke cycle of the main piston within the injector.

The shot from the first line charges the injector cylinder with lubricant at the same time raising the main piston, whilst that from the second line provides the pressure for the return stroke, which ejects the lubricant into the bearing.

On Stand No. 2, Row W, Empire Hall, *Murex Welding Processes, Ltd.*, are displaying new electric arc welding equipments and electrodes and demonstrate how the Murex Research Department aids industry. This theme is illustrated by a series of instructional displays which show the wide scope of the research work undertaken by the company.

Among the other exhibits is a comprehensive display of Murex arc welding electrodes, including the new Fortrex range of hydrogen controlled electrodes. Also shown is the Coilex electrode, a new double wire wound flux extruded continuous electrode for the automatic arc welding of mild steel.

METALS, MINERALS AND ALLOYS

COPPER.—Too late for our last week's issue Anaconda announced a further 3 c. increase in its copper price. This announcement was closely followed by similar increases from the majority of American producers, aside from Kennecott which waited until yesterday to bring its prices into line with the higher level. This second price increase coming within little more than a week of the earlier 4 c. rise appears to have been something of a surprise to the market. Be that as it may, it seems a reasonable assumption that this further increase has come about as the result of increased Chilean pressure.

It was suggested in this column some weeks ago that there would be little purpose in American producers raising their fixed price except in return for an undertaking from the Chilean government that a larger proportion of output would be made available to the American market. Nevertheless the rise to 40 c. coincided with the statement from the Chilean Minister of Mines that his Government would adhere to their demand that only 35 per cent of American copper should go to the States. Whether this exactly represents the amount of Chile's contractual liabilities at the fixed producers price, or whether Chile is free to sell a portion of this tonnage at the world price we do not know, but in any event the amount of "free" copper on the basis of this percentage cannot be large.

As the American producers' price, despite the recent 7 c. increases, is still a long way below the world price, it is difficult to see what advantage the American producers are gaining by raising their price without some specific *quid pro quo* in the shape of a guarantee of increased Chilean shipments. These cannot in any event be expected to materialize for some months, as it has already been announced that the whole of this year's Chilean production has already been sold forward. It may well be, of course, that some such understanding is implicit in last week's 3 c. price rise.

On the other hand, if this is not so, one cannot help wondering how seriously the American producers take their own warnings of the threat from substitution in the face of further price rises. The spokesman of one U.S. producer commenting on last week's price increase observed that it "won't open the way to substitutes because there's too much demand for copper and too many uses where the metal cannot be replaced by substitutes." Another comment was that "with industry's rapid growth we are going through a process of elimination. Copper is gaining new users that more than compensate for the older ones that are being relinquished to other metals in more plentiful supply." This realization can scarcely have come upon the industry with any recent suddenness and indeed it will be recalled that as long ago as last January, one of the leading Commonwealth producers was pointing out that under present conditions it was out of the question to visualize holding copper at any fixed price which would significantly influence its competitive position *vis-a-vis* substitutes.

In the face of all this, the more likely interpretation of recent U.S. pricing policy may perhaps be sought in the need for holding prices down as much as possible pending the conclusion of the recent wage negotiations in an industry where wage rates have always been much influenced by metal prices.

R.S.T.'s fixed price of £325 per ton has now been in force for just over the contractual 30 day period and the price becomes subject to revision at 24 hours notice. The general expectation appears to be that a further substantial increase in the R.S.T. price is now imminent.

As was to be expected, the continuing copper crises has lead the O.D.M. to announce from Washington the further postponement of the delivery to the government of the various tonnages of copper diverted from the stockpile during recent months. In total this amounts to 26,000 tons, of which 11,000 tons had, until the recent announcement, been due for repayment by December 31 next and the remaining 15,000 tons by March 31, 1956. At a recent meeting between the Copper Industry Advisory Committee, and the B.D.S.A., copper men were at pains to assure the Administration that the present difficult period could be handled without recourse to government direction, and that defence requirements and assistance to the flood areas of the north-east could be assured by informal co-operation within the industry. The C.I.A.C. is reported to have stated at this meeting that production will return to normal within the next three or four weeks while the B.D.S.A. have estimated that U.S. copper supplies should be slightly in excess of estimated consumption over the same period. Possibly because of this the C.I.A.C. is reported to have urged various easements in the restrictions on the export of copper scrap, which on balance would result in scrap copper export quotas being practically double those for the third quarter.

A nationwide stoppage of work is threatened in Chile where a state of emergency has been declared in the provinces of Santiago and Concepcion following a nationwide strike of customs and port officials who came out last week in support of the strike of tax and treasury officials. The government has characterized the strike as illegal.

Revenue from copper exports by the American-owned mines in Chile is for the rest of this year to be converted by the government at a basic rate of 200 pesos to the dollar. This agreement, reached after prolonged negotiation between the companies and the government, also provides that any production this year in excess of 420,000 tons will be converted at rates ranging from 245 to 300 pesos per dollar. In the free market the exchange rate has of late been in the neighbourhood of 800 pesos to the dollar.

LEAD.—Demand for lead on both sides of the Atlantic remains good but with no threat of a shortage we are unlikely to see any early change in the 15 c. level in the States. U.S. domestic lead consumption increased during the first six months of this year to a total of 570,942 s.tons compared with 542,190 s.tons in the corresponding period a year ago.

TIN.—Malaya's new legislative council met last Wednesday for the first time. Mr. Lennox-Boyd was present at the opening session and later addressed the assembly. Observing that many great problems lay ahead for the Council, he said "perhaps the greatest is the danger of subversion from within, for we must never forget the aim of world communism has not changed, even though its tactics may change. We may find subversion an even graver danger, even more difficult to meet than terrorism itself." In the course of the opening session, the Chief Minister of Malaya's first elected parliament, Tengku Abdul Rahman, reiterated his demands for independence within four years. The significance of recent political developments in Malaya and Singapore are discussed this week in our leading note and comment (see page 265).

Negotiations regarding rates of pay and conditions of employment have been in progress for some months now between the Eastern Smelting Company and the union representing the workers at the company's Penang smelter. Now the executive committee of the union has been empowered to take strike action if their demands are not met soon. These are reported to include leave with full pay for day rate workers, double pay for holiday work, equal annual bonuses for daily and monthly rated workers.

According to the U.S. Bureau of Mines, recovery of secondary tin in 1954 in the States fell by 5 per cent over the preceding year. Tonnage recovered last year amounted to 29,334 s. tons as against 30,914 s. tons in 1953.

ZINC.—U.S. zinc consumption, which recorded a sharp increase in the first six months of this year (538,733 s.tons against 419,973 s.tons for the corresponding period of 1954), continues exceptionally strong with some buyers ready to make commitments through to the end of the year. Curtailment of brass-making due to the Connecticut floods is not expected to affect appreciably the demand for regular high-grade zinc, as producers are planning to step up output at their other plants. Moreover, the anticipated decline in demand from the automobile industry for die casting has not developed and special high-grade metal is now on a voluntary allocation basis. The high level of galvanizing activity also shows no signs of slackening. In the circumstances it would not be surprising to see an advance in the U.S. zinc price even without any lead from London.

NICKEL.—Mr. Arthur Fleming, head of the Office of Defence Mobilization, has made public a letter to Mr. Sinclair Weekes, Commerce Secretary, authorizing the diversion this month of an additional 625 s.tons of nickel. This step had been recommended by the Assistant Commerce Secretary, Mr. Lothair Teetor, who said that the nickel supply situation in the U.S. continued to be serious in the face of an expected increase in industrial operations during the remainder of this year and of the sustained high level of defence demands. The additional 625 s.tons is over and above the 500 s.tons previously authorized by O.D.M. to be made available during September. None of the nickel will come from the national stockpile.

URANIUM.—There have been a number of interesting and important developments concerning uranium throughout the world since we last reviewed the situation in these columns.

The confusion in Canada concerning the Government's purchasing policy would appear to have been clarified by Mr. Howe's recent statement that the Canadian Government will cease to negotiate contracts to purchase uranium at prices higher than the basic guaranteed price of $7.25 per lb. after the end of March 31, 1956. This will not affect the Governments guaranteed price policy which will continue to be effective until the previously announced expiry date of March 31,

1962. At present there appears to be at least five uranium companies holding contracts with the Government-owned buying company, Eldorado Mining and Refining. These are Gunnar Mines, in the Beaverlodge area of Northern Saskatchewan; Algom, in the blind river area of Ontario; Pronto Uranium, which came into production at the beginning of this week in the same area; Bicroft Uranium in Ontario, and Consolidated Denison Mines. The last mentioned company has only recently announced its new contract which covers the sale of $182,000,000 worth of concentrates spread over the period from July, 1957, to March 31, 1962.

Meanwhile in Australia the South Australian Government is to proceed with legislation providing for the State Mines Department to negotiate with private companies for the establishment of a uranium mine at Mount Victoria in the eastern part of the state. In making this announcement the Premier, Mr. Thomas Playford, said that a sufficiently large body of ore had been discovered in the Mount Victoria area to justify the establishment of a mine and concentration plant, while investigations at Crockers Well nearby had revealed sufficient ore for high-grade development. The uranium produced at the new mine would be treated at the Port Pirie plant and Mr. Playford said that the Government propose to buy the ore mined from these two sites.

In connection with the discussions taking place between Australia and this country about Australia's uranium prospects and disposal of uranium oxide from local sources, the U.K. Atomic Energy Authority is sending two technical experts to Australia to examine uranium prospects of "current interest". Whether or not this will include Mount Victoria and Crockers Well is not known but the two U.K. representatives will, in any event, be inspecting the Mary Kathleen lease in Queensland and prospects in the Aligator River area in the Northern Territory.

The value of uranium and thorium produced in South Africa continues to advance and the latest figures show that the value of uranium and thorium during May was £2,196,614 against £1,031,749 in May, 1954. The total value for the first five months of this year now stands at £9,914,294 against £4,610,283 in the corresponding period of 1954.

In Northern Nigeria diamond drilling at Kabba has disclosed uranium and niobium but it is not yet known whether the deposit is a commercial proposition.

In Central Africa a large-scale exploration programme has been embarked upon by several British mining companies. So far radioactive minerals have not been produced within the Federation, although one small deposit of uranium ore is at present being developed in Northern Rhodesia and many uneconomic occurrences are known which give promise of useful discoveries being made in the future. These remarks were made by Mr. C. F. Davidson of the Geological Survey of Great Britain recently in Geneva where he also declared that the geological conditions in the Sinoia district of Southern Rhodesia were particularly favourable for prospecting. The "Gold Belts" of Southern Rhodesia, unlike the gold deposits of the Witwatersrand, have not as yet been found to be a promising source of uranium mineralization .

ZIRCONIUM AND HAFNIUM.—The U.S. Atomic Energy Commission has announced that it is inviting proposals for the delivery of up to 2,000,000 lb. of zirconium metal and for as much hafnium metal as can be produced in the processing of the zirconium. The two metals, the Commission stated, are needed to meet the increasing requirements of its reactor development programme and of currently scheduled naval projects.

The deadline for the receipt of the proposals is February, 1956, and the date for starting deliveries is expected to be fixed for July, 1957. In addition to the Commission's purchases it was stated that quantities of the two metals might be required in the future for privately financed nuclear power projects although the Commission did not itself intend to provide either of the two metals for private project.

At present the A.E.C. has a contract with Carborundum Metals Co., Inc., Akron, New York, which calls for a yearly delivery of 200,000 lb. of zirconium and 4,000 lb. of hafnium. The new procurement programme will be additional to these amounts.

The London Metal Market

(From Our Metal Exchange Correspondent)

The chief feature in the copper market was the news received late on Thursday evening, August 25, that the Anaconda Copper Co. in America had raised its domestic price by 3 c. to 43 c. per lb., and other producers (except Kennecott) quickly followed suit. This rise, following so nearly on the heels of the recent advance to 40 c., came as a surprise and was the signal for a further rapid advance on the London market where prices on Tuesday touched a new record of £400 for "cash" and £395 for the forward position. The Rhodesian Selection Trust's price is fixed at £325 per ton until the end of the month, and it remains to be seen whether it will feel bound to increase this figure and by how much.

Both the American domestic price and that of the R.S.T. are, of course, considerably below world prices, as Continental buyers are reported to be paying 48 c. for the first quarter of 1956. At the end of last week the office of Defence Mobilization announced the postponement of delivery to the stockpile of about 26,000 s.tons until June 30, 1956. It is since learned that Kennecott has now fallen into line at 43 c.

There seems to be very little interest in the tin market and prices have tended to sag, although consumptive demand is reported to be keeping up well. Supplies of near metal seem ample and the backwardation has disappeared for the time being. On Thursday morning the Eastern price was equivalent to £759½ per ton c.i.f. Europe.

Lead and zinc maintain a good undertone and consumption seems to be at a satisfactory level.

Closing prices and turnovers are given in the following table:—

	August 25		September 1	
	Buyers	*Sellers*	*Buyers*	*Sellers*
Copper				
Cash	£371	£371½	£393	£394
Three months	£364½	£365	£387	£387½
Settlement	£371½		£394	
Week's turnover	3,700 tons		4,750 tons	
Tin				
Cash	£747	£748	£747½	£748
Three months	£747	£748	£747	£748
Settlement	£748		£748	
Week's turnover	350 tons		660 tons	
Lead				
Current half month	£106½	£107	£107	£107½
Three months	£105½	£106	£106½	£107
Week's turnover	1,850 tons		2,475 tons	
Zinc				
Current half month	£89½	£89¾	£90¼	£90½
Three months	£89¼	£89½	£89¾	£90
Week's turnover	1,925 tons		4,525 tons	

OTHER LONDON PRICES — SEPTEMBER 1

METALS

Aluminium, 99.5%, £171 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60% basis) 23s. 6d./24s. 6d. nom. per unit, c.i.f.
Bismuth
(min. 1 ton lots) 16s. lb.
Cadmium 11s. 6d.
Chromium, 6s. 11d./7s. 4d. lb.
Cobalt, 21s. lb.
Gold, 251s. 5d.
Iridium, £30 oz. nom.
Manganese Metal (96%-98%) £269 according to quantity
Magnesium, 2s. 4d. lb.
Nickel, 99.5% (home trade) £519 per ton
Osmium, £24/27 oz. nom.
Osmiridium, £40 oz. nom.
Palladium, £7 0s./£7 10s. oz.
Platinum U.K. and Empire Refined £29 oz. Imported £31 oz.
Rhodium, £40
Ruthenium, £17 oz.
Quicksilver, £90/£95 ex-warehouse
Selenium, 43s. nom. per lb.
Silver, 78¾d. f.oz. spot and 78¾d. f'd
Tellurium, 15s. lb.

ORES, ALLOYS, ETC.

Bismuth .. .. 20% 3s. 3d. lb. c.i.f.
60% 8s. 3d. lb. c.i.f.
Chrome Ore—
Rhodesian Metallurgical (semi-friable) 48% £13 per ton c.i.f.
" Refractory 45% .. £13 per ton c.i.f.
" Smalls 42% .. £10 2s. 6d. per ton c.i.f.
Magnesite, ground calcined .. £26-£27 d/d
Magnesite, Raw .. .. £10-£11 d/d
Molybdenite (85% basis) .. 105s. 0d.-108s. 0d. per unit c.i.f.
Wolfram and Scheelite (65%) .. 256s./260s. c.i.f.
Tungsten Metal Powder .. 20s. 6d. nom. per lb. (home)
(98% Min. W.)
Ferro-tungsten (80%-85%) .. 17s. 6d. nom. per lb. (home)
Carbide, 4-cwt. lots .. .. £39 3s. 9d. d/d per ton
Ferro-manganese, home .. £54 10s. 0d. per ton
Manganese Ore Indian c.i.f. Europe (46%-48%) basis 100s. freight. .. .. .. 82d./84d. per unit c.i.f.
Manganese Ore (38%-40%) .. 68d. per unit
Brass Wire .. .. 3s. 6½d. per lb. basis
Brass Tubes, solid drawn .. 2s. 11¾d. per lb. basis

THE MINING MARKETS

(By Our Stock Exchange Correspondent)

Gilt-edged during the past week were flat. The Uganda Loan opened at a considerable discount and then moved lower. The Prime Minister's warning about the nation's economy, coupled with the threat of further wage demands, led to fears that an even higher Bank Rate might be imminent. There is no doubt that if the Chancellor feels it to be necessary he will adopt harsher measures than those already undertaken.

An interesting factual statement was made by the chairman of the Stock Exchange concerning the relation between dividends, wages, salaries and company profits. Since 1947 wages and salaries have advanced by nearly 70 per cent against an increase of about 32 per cent in interest and dividends. The increase in wages and salaries, in volume, was some 14 times that of interest on dividends.

In mining markets, more confidence was shown in Kaffirs and selective buying developed, particularly from the Continent, many of the leading finance houses went ahead. Among individual Rand mines, the selective demand for some of the older producers was particularly noticeable. A sharp gain by Dominion Reefs was attributed to the completion of a large selling order.

In the Orange Free State section, good rises were shown by some of the leading companies. Free State Geduld moved ahead sharply on rumours emanating from Johannesburg that good results were being obtained from the property. President Brand hardened on hopes of a maiden dividend this year and Orange Free State Investment Trust shares and President Steyn moved upwards in sympathy.

In the West African market, the better returns from Amalgamated Banket received scant recognition due to idle conditions. Ashanti were again easier on rumours of large selling orders.

Western Mining declined due to disappointment with the group's results from outside activities such as oil and the uranium prospecting. Gold Mines of Kalgoorlie were slightly harder on the maintained distribution and hopes that when the consolidated accounts are produced next year, results may prove markedly better.

In the miscellaneous gold market, Indian mines were unaffected by the news that an unofficial strike on the field had come to an end. Zambesies, however, recorded a large gain following the publicity given in the press to the value of the company's holdings in Tanganyika Concessions. This concern's investments were estimated to be worth some 64s. a share.

Coppers started the week well. Substantial buying orders from the Continent and the United States found the market ill-supplied with stock and sharp gains resulted. During the week, copper touched an all-time record price of £400 per ton but failed to hold this level. This market finished the week erratically, investors obviously fearing the result of a setback in the price of copper on share prices at their current level. The chairman of Chartered died during the period and this caused an immediate setback in the shares.

Quiet buying on the long term view brought about small all round gains in Eastern tins. An exception was Ayer Hitam. The company's issue of new shares at 22s. 6d. each caused a sharp drop in the price. The market was disappointed at the long time that must elapse before the newly-aquired dredge can show any effect on the company's results.

In the Nigerian and miscellaneous section, share prices were little altered although the favourable position of Geevor kept these shares at a steady level.

In the lead/zinc market, share prices showed an all round improvement although gains were generally of a fairly modest nature. Mount Isa were an exception and went ahead well in anticipation of the profits that the company stand to gain from their copper production.

There was renewed interest in Associated Manganese although the maintained dividend from Central Provinces Manganese disappointed some of the bulls. Consolidated Murchison again responded to the higher price of antimony.

Finance	Price Aug. 31	+ or — on week
African & European	3½	+ ⅛
Anglo American Corpn.	9½	+ ⅛
Anglo-French	22/-	.....
Anglo Transvaal Consol.	25/7½	—7½d
Central Mining (£1 shrs.)	47/6	+3d
Consolidated Goldfields	63/-	+6d
Consol. Mines Selection	41/10½	+1/3
East Rand Consols	2/-	.....
General Mining	4½	+ ⅛
H.E. Prop.	8/7½	—1½d
Johnnies	45/6	+1/-
Rand Mines	3⅜	.....
Rand Selection	46/3	+3/1½
Union Corporation	49/6	+1/6
Vereeniging Estates	4½	+ ⅛
Writs	43/1½	—7½d
West Wits	40/-	+9d
Rand Gold		
Blyvoors	28/-	+9d
Brakpan	7/6	+6d
Buffelsfontein	38/9	—6d
City Deep	12/9	+6d
Consol. Main Reef	22/6	.....
Crown	2½	.....
Daggas	2⅛	+ ⅛
Dominion Reefs	35/9	+1/4½
Doornfontein	27/3	+9d
Durban Deep	35/-	.....
E. Champs	6/-	.....
E. Daggas	10/-	+3d
E. Geduld (4s. units)	31/6	+6d
E. Rand Props.	3½	+ ⅛
Geduld	4¼	+ ⅛
Govt. Areas	7/6	+3d
Grootvlei	23/-	+1/3
Hartebeestfontein	37/9	—9d
Libanon	8/4½	+4½d
Luipaards Vlei	20/6	—3d
Marievale	22/-	+9d
New Kleinfontein	7/3	+3d
New Pioneer	13/-	+3d
Randfontein	60/-	+1/6
Robinson Deep	17/9	—3d
Rose Deep	10/3	—3d
Simmer & Jack	4/6	+1½d
S.A. Lands	22/6	+7½d
Springs	3/4½	+6d
Stilfontein	27/9	+9d
Sub Nigel	36/3	+7½d
Vaal Reefs	32/3	+6d
Van Dyk	3/6	+3d
Venterspost	14/7½	+10½d
Vlakfontein	18/3	+1/3
Vogelstruisbult	31/3	.....
West Driefontein	5⅛	+ ⅛
Rand Gold contd.		
W. Rand Consolidated	44/4½	+7½d
Western Reefs	39/4½	+1/3
O.F.S. Gold		
Freddies	8/9	+3d
Freddies Consolidated	4/10½	+4½d
F.S. Geduld	4⅛	+ ⅛
Geoffries	15/6	+6d
Harmony	32/9	+1/9
Loraine	6/4½	+1½d
Lydenburg Estates	18/-	+6d
Merriespruit	9/10½	+1½d
Middle Wits	14/7½	+7½d
Ofsits	68/6	+3/6
President Brand	72/6	+1/10½
President Steyn	39/3	+1/9
St. Helena	30/6	+6d
Virginia Ord.	12/6	.....
Welkom	20/3	+9d
Western Holdings	4½	+ ⅛
West African Gold		
Amalgamated Banket	2/1½	+1½d
Ariston	6/3	+3d
Ashanti	21/6	—3d
Bibiani	4/4½	+1½d
Bremang	1/4½	.....
G.C. Main Reef	2/9	.....
Konongo	2/9	.....
Lyndhurst Deep	1/3	.....
Marlu	7½dxc	.....
Taquah	2/-	.....
Western Selection	8/9	—3d
Australian Gold		
Gold Mines of Kalgoorlie	13/6	+3d
Great Boulder Prop	10/9	+3d
Lake View & Star	19/6	+3d
Mount Morgan	22/9	.....
North Kalgurli	6/9	.....
Sons of Gwalia	4/3	.....
Western Mining	8/7½	—4½d
Miscellaneous Gold		
Cam & Motor	8/10½	+3d
Champion Reef	4/6	.....
Falcon Mines	6/10½	.....
Globe & Phoenix	25/6	.....
G.P. Rhodesian	6/7½	+1½d
Motapa	1/4½	.....
Mysore	3/4½	+3d
Nundydroog	7/3	.....
Ooregum	4/3	.....
St. John d'El Rey	15/-	.....
Zams	61/10½	+5/7½
Diamonds and Platinum		
Anglo American Inv.	9½	—½
Casts	27/9	—1/-
Cons. Diam. of S.W.A.	7	.....
De Beers Defd. Bearer	6⅜	+ ⅛
De Beers Pfd. Bearer	16½	—¼
Pots Platinum	9/6	—6d
Waterval	16/9	—6d
Copper		
Bancroft	45/-	+4/-
Chartered	74/-	—6d
Esperanza	3/10½	—1½d
Messina	9¼	.....
Nchanga	16½	+⅛
Rhod. Anglo-American	6⅛	.....
Rhod. Katanga	22/9	+1/9
Rhodesian Selection	50/-	+2/10½
Rhokana	48½	—¼
Rio Tinto	3⅜	+ ⅛
Roan Antelope	29/6	+6d
Selection Trust	4⅛	+ ⅛
Tanks	9	—⅛
Tharsis Sulphur Br.	6½	+ ¼
Tin (Eastern)		
Ayer Hitam	23/3xc	.....
Gopeng	9/3	+1½d
Hongkong	7/6	.....
Ipoh	22/6	+6d
Kamunting	9/9	+9d
Kepong Dredging	3/6	.....
Kinta Tin Mines	16/-	+3d
Malayan Dredging	9/6	+3d
Pahang	13/-	—1½d
Pengkalen	12/-	+1½d
Petaling	10/3	.....
Rambutan	19/-	.....
Siamese Tin	8/-	+1½d
Southern Kinta	19/9	+6d
S. Malayan	8/7½	.....
S. Trosoh	9/1½	+1/4½
Sungei Kinta	14/6	+3d
Tekka Taiping	7/9	.....
Tronoh	9/-	+1½d
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	13/-	.....
Beralt Tin	38/3	+1/9
Bisichi	5/9	.....
British Tin Inv.	23/9	+1/9
Ex-Lands Nigeria	2/4½	+1½d
Geevor Tin	14/4½xd	£—1½d
Tin (Nigerian and Miscellaneous) contd.		
Gold & Base Metal	1/10½	.....
Jantar Nigeria	6/10½	.....
Jos Tin Area	14/9	.....
Kaduna Prospectors	2/1½	.....
Kaduna Syndicate	3/-	.....
London Tin	9/10½	+1½d
United Tin	2/-	.....
Silver, Lead, Zinc		
Broken Hill South	56/9	+9d
Burma Mines	2/7½	+1½d
Consol. Zinc	53/9	+2/9
Lake George	12/6	+6d
Mount Isa	62/6	+4/6
New Broken Hill	40/6	+2/-
North Broken Hill	76/10½	+4½d
Rhodesian Broken Hill	13/7½	+1½d
San Francisco Mines	22/9	+3d
Uruwira	6/7½	—4½d
Miscellaneous Base Metals and Coal		
Amal. Collieries of S.A.	50/7½	+1½d
Associated Manganese	38/-	+3/4½
Cape Asbestos	9/10½	—3d
C.P. Manganese	33/9	—1/3
Consol. Murchison	60/-	+3/1½
Natal Navigation	2⅜	.....
Turner & Newall	104/6	+6d
Wankie	17/6	.....
Witbank Colliery	4	.....
Canadian Mines		
Dome	$28	—1
Hollinger	$42	—½
Hudson Bay Mining	$125½	+3
International Nickel	$154½	+7½
Mining Corpn. of Canada	£9½	+ ⅛
Noranda	$111½	+4½
Quemont	£10⅛	+ ¼
Yukon	4/3	.....
Oil		
British Petroleum	5⅜	—⅛
Apex	34/6	.....
Attock	40/-	.....
Burmah	3⅜	—⅛
Canadian Eagle	61/6	—2/3
Mexican Eagle	22/3	.....
Shell	6⅜	—⅛
Trinidad Leasehold	37/6	—1/6
T.P.D.	24/3	+3d
Ultramar	28/3	—3d

COMPANY NEWS AND VIEWS

W.M.C.: An Interesting Australian Growth Stock

One would think that a group such as Western Mining Corporation, which had increased its consolidated earnings from £A146,997 to £A695,482 over a period of some six years, and total assets from £A2,027,560 to £A4,498,162, would have caused the market to reflect such notable achievements in the quoted value of its shares by a substantial rise in price. But this has not been the case.

The 5s. shares of W.M.C. quoted on the London Stock Exchange in English currency at their present level of about 9s. have fallen sharply from the high point reached of 15s. 3d. during 1954. Moreover, despite the great progress made by the corporation, the present price differs only very slightly from the average of about 10s. 6d. during the past four years. This low valuation of W.M.C.'s interests and future prospects is reflected in the substantial return of nearly 9 per cent which is at present obtainable from an investment in the 5s. shares.

Of course, during this period of expansion the issued capital of W.M.C. has not remained unchanged but has risen from £A324,833 in 1949 to the present figure of £A815,019 of which £A116,431 has only been called up to the extent of A2s. 6d. a share.

Year to Mar. 31	*Total Revenue* £	*Ex-penses** £	*Net Profit†* £	*Divi-dends* £	*To Reserve* £	*Carry Forward* £
1955	695,482	35,310	605,262	139,718	50,481	2,025,801
1954	635,399	35,422	563,474	139,718	158,270	1,420,539

* Administration and general.
† Including £293,783 Minority interests (1954 — £258,371.)

A good many people might feel that a return of nearly 9 per cent was not unreasonable from a company carrying out mining operations in a country where the procurement and management of labour is notoriously difficult, and where the undertakings are not large enough to enable cost increases easily to be offset by higher production. Too, Australian gold mining—although subsidized to some extent, and free from the burden of taxation—is dependent upon restricted and somewhat irregular deposits.

Yet to judge Western Mining Corporation from this standpoint only would be to ignore entirely its growth character, which should be the essence of any assessment of this young and go-ahead organization's future. Since 1949 when W.M.C. amalgamated with its former holding company, the Gold Exploration and Finance Company of Australia, much progress has been made. Operating on the well defined lines of the South African gold mining finance houses a cohesive organization with efficient and uniform management and consultancy services has been built up, the Corporation now represents the most important gold mining group in Australia.

Indeed, the Corporation's interests are as widespread as they are diversified. And although its main interests still centre around gold mining in Western Australia—predominantly in the Kalgoorlie field—mining operations extend as far as the south-eastern corner of the sub-Continent where the Central Victoria Dredging Company N.L. is working rivers for gold. It is, however, in the sphere of exploration which now includes uranium, gold and oil, that one should look for future progress.

Amongst the W.M.C.'s gold interests, the most important is that held in the Central Norsemen Gold Corporation N.L. This property, which has been revitalized, is closely bound up with the group's profit expansion over the past few years. During 1949 the mine milled 123,277 tons of ore at a grade of 7.19 dwts. per ton. During the past financial year ending March 31, 1955, the grade recovered ran at 10.52 dwts. for the 157,867 tons milled. Reflecting this improvement, revenue earned in respect of the past year moved up to £A1,306,912 compared with £A482,879 during 1949.

Another property—which will probably become one of the largest gold mining undertakings in Australia—namely the Great Western Consolidated Mine situated at Southern Cross, in a south-westerly direction towards Perth from the Kalgoorlie field has been brought to production by the Corporation. This property is engaged in gold mining by underground and open cut methods and as at March 22, 1955, ore reserves to the extent of 925,000 tons with a grade of 3.3 dwts. per ton had been established at the Copperhead deposit where work is being initially concentrated. Production started in November, 1952, and during the past financial year total revenue was £A885,940. The outlook for this property is regarded as being most promising.

W.M.C. is also rapidly extending its influence in the Kalgoorlie mining field. This is being achieved through the medium of Gold Mines of Kalgoorlie (Aust.). During the past financial year these properties in this area were acquired: South Kalgurli Consolidated, Boulder Perseverence, and Kalgoorlie Enterprise Mines. Fresh finance was recently raised by G.M.K. (Aust.) to finance these new purchases. Earlier, during 1952, G.M.K. (Aust.) had bought leases lying contiguous to its own ground from the Paringa Mining Company. What the company's policy might be in future is, of course, not known, but there are many who believe that the expansionist programme on which it has embarked has still a good way to go. There is little doubt, that by applying a uniform method of management and technical control, a consolidation of interests on the

Gold Producing Companies	*W.M.C.'s direct Holdings of issued capital Shares/Stock*	*%*	*Year to March 31*	*Tons Milled*	*Grade (dwt.)*	*Yield (oz.)*	*Bullion Revenue§* £A	*Gold Premium* £A	*Taxation* £A	*Net Profit* £A	*Dividend* s. d.	*Carry Forward* £A
Central Norseman £A650,000 in 5s. shares	1,312,500	50	1955 1954	157,867 155,314	10.5 10.0	83,023 77,410	1,305,904 1,210,428	1,008 18,538	Nil 788	592,999 514,394	3 0 3 0	464,041 361,042
G.M.K. (Aust.) £A934,755 in 10s. stock (*f*)	924,454*d*	25	1955 1954	199,950*c* 196,471*c*	5.6*c* 5.8*c*	55,603*c* 56,908*c*	865,433 878,749	684 12,528	179 63	102,922 184,265	1 6 1 6	132,764 165,897
New Coolgardie £A511,200 in 10s. shares	534,062	52	1955 1954	66,201 68,393	10.4 9.4	34,342 32,000	535,412 495,473	419 7,505	Nil 131	20,880 1,676	Nil 0 6	268,830 247,950
Gt. Western Consol* £A1,768,000 in 10s. shares	500,000	14	1955 1954	421,144 420,129	2.7 2.4	56,628 51,143	885,217 792,907	723 12,909	Nil Nil	32,631 14,445	Nil Nil	16,792 DR6,734
Central Victoria Dredging £A390,000 in 10s. shares	395,500	50	1955 1954	1,290.5† 2,778.6†	1.5‡ 1.8‡	4,144 10,576	89,289 162,772	— 2,274	62 16	DR18,444 4,467	Nil Nil	129,337 148,570
Prospecting Etc. Cos. Gold Mines of Australia (*a*) £A52,219 in 2s. 6d. shares	260,500	62	1955	Carrying out gold prospecting at Stawell, Victoria. Also prospecting for uranium in Queensland with W.M.C. In addition, participations taken in joint venture for Western Australian oil exploration.								
Victoria Gold Dredging £A129,500 (*b*)	110,600	44	1955	Ceased operations. Now holds 125,000 fully paid shares in Central Victoria Dredging.								
Kalgoorlie Southern £A185,225 in 5s. shares (*g*)	320,705*e*	22	1955	Company is testing areas south of the Golden Mile by diamond drilling for a repetition of the Kalgoorlie system of ore veins.								
Champagne Syndicate	52,000	100	1955	Holds leases of Mt. Charlotte (Kalgoorlie)								

* Production commenced November 1952. W.M.C. holds an option until May 25, 1958, to subscribe for 500,000 cos. 10s. shares at 2s. discount.
† Million cubic yards dredged.
‡ Grains of gold per cu. yd.
§ After realisation charges.
a Company acts as General Managers and Consultants to Central Victoria Dredging, Morning Star (G.M.A.) Mount Coolon Gold Mines and Victoria Gold Dredging.
b 9,000 £1 shares fully paid and 241,000 £1 shares paid to 10s. only.
c Excluding tribute ore.
d Shareholdings comprise 462,227 fully paid 10s. shares and 462,227 10s. shares paid to 5s. The latter shares were acquired since the close of the financial year.
e Shareholdings comprise 154,240 fully paid 5s. shares and 166,465 shares of 5s. paid to 1s.
f Also £467,377 shares of 10s. paid to 5s.
g Also £37,045 shares of 5s. paid to 1s.

Golden Mile would prove more profitable than the past method of operating as smaller individual companies.

Perhaps the principal reason for regarding W.M.C. as a growth stock is the great interest it has taken in exploration activities. With regards to gold, investigations are constantly being undertaken with a view to opening up new properties and the most irteresting exploratory work at present is that being carried out by Kalgoorlie Southern Gold Mines N.L. This company has been drilling in an area south of the Kalgoorlie field for some time in order to prove or disprove the existence of an extension of the famous Golden Mile. Results so far have been encouraging and testing is therefore being continued. From the investors' point of view, should this project succeed the establishment of one or more mines could be an event of exceptional importance.

The past year's report from W.M.C. gives little information of an optimistic nature concerning the search for uranium. It does state, however, that disappointing results in Queensland have caused options in that area to be abandoned. But prospecting is, apparently, now taking place in the East Kimberley area of Western Australia. Nothing of importance has yet been found.

As stated a year ago a joint venture for petroleum exploration has been formed in Western Australia. The members participating are Shell with a 75 per cent interest, North Broken Hill and Broken Hill South with 7½ per cent each and W.M.C. with 10 per cent (one-tenth of the latter holding has been made available to Gold Mines of Australia). No areas of interest have yet been secured.

An interesting feature of exploration activities carried out by the Corporation during the past year is an investigation of lithium-bearing pegmatites. Isotopes of the element lithium are essential constituents for the release of fusion energy as in the H. Bomb.

Although the W.M.C. operates on the same lines as a South African finance house, there are one or two differences. Perhaps most notable amongst these, is the lack of share dealing profits which play so great a part in boosting the revenue of other gold mining groups. While this may have been due in the past to lack of market interest there is nothing to prevent a change in this respect in the future. The ability to make profits from share dealing, however, is directly dependent upon the progress of the group in the technical field together with its ability to introduce profitable properties for public subscription. Recently gold share markets have been dull. But there are clear signs that investors are now turning towards the gold share market, not only because of the possibility of a higher gold price through a "floating" pound, but also on the sheer investment merit and yield considerations of several gold mining shares. Bearing this in mind the 5s. shares of Western Mining Corporation at their current price of 9s. to yield nearly 9 per cent, look attractive.

Mount Coolon Makes Loss

Due to the absence of any dividend from Morning Star (G.M.A.) in which Mount Coolon Gold Mines has an investment amounting to 102,100 shares, a net loss of £A756 was incurred by the company during the year ended December 31, 1954. This compared with a net profit of £14,346 during the preceding year.

In addition to its holding in Morning Star, the company has a stake amounting to 35,300 shares in Great Western Consolidated N.L.—the promising new gold property situated at Southern Cross to the south-west of the Kalgoorlie field.

Although Mount Coolon is at present going through a difficult period, the completion of Morning Star's capital expenditure programme must before long result in the resumption of dividends. As regards the holding in Great Western Consolidated, production at this new mine was only started in November, 1952, but present indications suggest that some initial distribution will not be long in forthcoming.

Mr. G. Lindesay Clark is chairman. Meeting, Melbourne, Australia, September 12

Morning Star's Fall in Grade

The report and accounts for the year ended March 31, 1955, of Morning Star (G.M.A.) Mines, N.L., for which Gold Mines of Australia acts as general managers and consultants, discloses that the average grade of ore treated suffered a severe drop to 12.26 dwt. per ton from 19.39 dwt. A total of 16,909 tons was milled as compared with 18,167 tons for a recovery of 10,087 oz. of fine gold as against 17,199 oz. In addition, 405 tons (580) of concentrates, estimated to contain 281 oz. (412), were stacked at the mine for treatment.

This severe drop in gold recovered, together with a lower rate of output, naturally resulted in the considerable fall in total revenue to £A160,421 from £A275,578. After expenses, net profits were £A29,513 as compared with £A114,732.

Owing to the heavy programme of capital expenditure at present in progress at the mine no distribution was made. During the financial year ended March 31, 1954, a total of A2s. per share was paid on the issued ordinary capital of £A100,000 in A4s. units.

As at the end of the past financial year ore reserves were estimated at 32,000 tons averaging 10.5 dwt. per ton. This compared with 40,000 tons averaging 12.5 dwt. per ton previously.

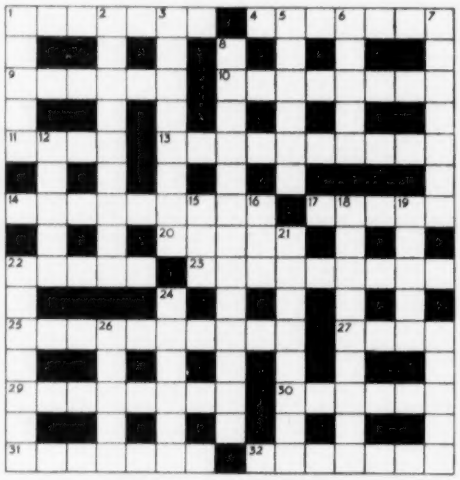
Mr. G. Lindesay Clark is chairman. Meeting, Melbourne, Australia, September 12.

Tronoh's Higher Values

All four of Tronoh Mines' Dredges treated higher grade ore during the year ended December 31, 1954. This was the main reason for an increased production of tin concentrates at 2,595 tons, as compared with 1,982 tons during the previous year. Assisted by a higher price of tin, net profits moved up sharply to £329,393 from £233,104. Dividends absorbed £216,375 against £130,500 and the balance carried forward was increased to £348,482 from £271,870.

The company's Siamese subsidiary, Tin Lay, also had a successful year with revenue increased to £136,422 from £95,384 during its year also ended December 31, 1954. No dividend was paid to the parent and the balance of unappropriated profits rose to £31,422 from £27,512. A total of 310 tons of tin ore were recovered at this property compared with 185 tons in 1953.

A strong position is revealed from Tronoh Mines' balance sheet as at December 31, 1954, with total assets increased to



'UNICONE' CROSSWORD No. 9

ACROSS.—1. An Australian 9 (7). 4. Just a glimmer of light (7). 9. It would hardly describe a cabbage for example (6). 10. No sorrow after a draught of it (8). 11. Make lime or bricks in it (4). 13. Shout or see a repositary (10). 14. Al is let in by the confused Keeper of the Gate (9). 17. Good place to lie after a drive. (5). 20. Helps milady to blush unseen (5). 22. The odds are even you'll get this (5). 23. A personal background implied by such a place name (9). 25. A spice isle does (10). 27. A scottish river (4). 29. Performer of a public duty (8). 30. Hugh is an operatic one (6). 31. They belong to one in a relative way (7). 32. A tortured yell from a maltreated cur (7).

DOWN.—1. Sounds a good stretch on the seashore (5). 2. In thin sheets and not much space between (9). 3. The graduate gets a mixed sort of shine for support (8). 5. Flopped is here (6). 6. Division of a poem (5). 7. Where girlish tasks are done (7). 8. Rot in Republic—Unthinkable ! (13). 12. I count this as a cross (5). 15. Something to do to the line (3). 16. It is I. 18. Does it smell any better than another (5, 4). 19. Crow (5). 21. Bring into being (8). 22. Chop around an eccentric cry for help (7). 24. Easy French (6). 26. Greets (5). 28. A man to plunder (5).

Solution on page 274

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£2,036,279 from £1,751,322 in respect of the previous year. Under the heading of current assets an item of particular interest is that of quoted investments, sharply up at £907,245 from £414,105. Market value of these holdings as at December 31, 1954, was £1,151,216. The company's net liquid assets amount to nearly a £1,000,000, about a quarter of this figure being represented by cash.

South Tronoh's Recovery

Having successfully dealt with the problems of the year 1953, which involved extensive repairs to one of its dredges, and difficult working conditions encountered by the other, Southern Tronoh Tin Dredging made a sharp recovery in production during the year ended December 31, 1954.

With output of tin concentrates up at 1,167 tons from only 190 tons during the preceding 12 months, together with an increased price received for its product, the company's total revenue advanced to £516,238 from £225,443. After taxation and expenses, dividends absorbed £33,000 (nil) while the balance of unappropriated rose to £53,418 from £25,583.

Fall in Output at Kinta Kellas

As the past twelve months ended March 31, 1955, have been a period of transition for Kinta Kellas Tin Dredging Company during which the motive power of the company's dredge was converted from steam to electricity and its tables partially replaced by jigs, it is not surprising that production should have fallen from the previous year's level. Moreover, difficult and low grade ground created additional problems. On the other hand, the benefits of the programme have not taken long to show themselves in the form of reduced costs—a trend expected to become more pronounced in the future.

Year to Mar.31	*Cubic yds. Dredged* (000)	*Yield per cu. yd.* (lb.)	*Output tin ore* (tons)	*Cost per cu. yd.* s. d.	*Price per ton* £	*Tribute Prod'n.* (tons)
1955	1,475.0	.30	200	1 3	407	230
1954	1,486.6	.45	298	1 5	363	172

In view of the company's difficulties, it is a most satisfactory achievement that revenue earned did not fall substantially below that of the previous year.

Year to Mar.31	*Total Tin*	*Revenue Other*	*Expenses†* £	*Taxation* £	*Net Profit* £	*Carry forward** £
1955	86,754	9,641	86,186	Nil	1,120	23,391
1954	115,095	6,471	103,606	634	2,812	19,876

* After credits of £2,395 (1954 — £13,709).
† At the mine.

During the first four months of the current financial year a total of 42¼ tons of tin ore have been recovered as against 94½ during the previous corresponding period.

Rand and O.F.S. Returns for August

The August gold returns from mines in the Anglo American Group show many increases. President Brand reported profits up to £322,311 from £308,716. President Steyn's profits reached £150,850 (£144,305), while Welkom's profit advanced to £11,032 from £9,390. Loraine's loss fell to £30,036 from £37,322.

Beralt Tin Pays 10 Per Cent More

With the recommendation of a final dividend amounting to 80 per cent on the issued ordinary capital of £331,000 in stock units of 5s., Beralt Tin and Wolfram, the Portuguese wolfram/tin producer, has raised its total distribution for the year ended March 31, 1955, to 130 per cent as compared with 120 per cent previously.

Year to Mar.31	*Total Profit* £	*Taxation* £	*Net Profit* £	*Dividends* £	*To reserve* £	*Carry forward* £
1955	729,054*	398,484	330,570	243,285	80,000	261,785
1954	748,851	496,611	252,240	218,460	Nil	245,500

* After providing £28,755 for depreciation, etc.

BISICHI TIN CO. (NIGERIA) LTD.

The forty-fourth annual general meeting of Bisichi Tin Co. (Nigeria), Ltd., was held on August 30 at the Chartered Insurance Institute, London, E.C.

Mr. W. J. C. Richards, Chairman, presided, and in moving the adoption of the report and accounts for the year ended December 31, 1954, said:—

The International Agreement for regulating Tin production still awaits ratification by some of the countries concerned. If the agreement becomes effective a buffer pool will be formed for the purchase of surplus stocks of tin which will enable the governing body to adjust and maintain supply to demand and, it is thought, thus ensure a stable price for tin which is satisfactory to both producers and consumers. There are, of course, differences of opinion on the desirability of the regulation of output and on both sides there are impressive arguments. At this meeting I do not propose to enter into them but I consider shareholders should know that your Board were against the scheme. The majority of the Governments representing producers and consumers throughout the world, have signified acceptance of the scheme, and if it becomes law we must try to ensure that it produces the beneficial results for which it has been designed. To what extent it will affect your Company it is not yet possible to estimate accurately. As Tin and Columbite ores are found in association on your properties, we fear that any restriction on the production of Tin ore must restrict the output of Columbite.

The buffer pool has to be financed by producers and we have to be prepared for a heavy financial burden in this respect. We wish to carry it without recourse to borrowing and this is one of the reasons we are not paying an interim dividend on account of the current year. Had the previous year's interim of 10% been repeated, it would be a poor indication of our estimate of the years' profits. We hope to pay the dividend for this year, and hold the meeting early in the new fiscal year, say some time in May. As the final dividend for the past year, which you are shortly to be asked to confirm, is equal to the total of the final and the interim paid immediately after the last meeting, it is unlikely that shareholders have been inconvenienced by the decision to make one instead of two distributions.

The report and accounts were adopted.

EX-LANDS NIGERIA LTD.

The forty-third annual general meeting of Ex-Lands Nigeria, Ltd., was held on August 30 at the Chartered Insurance Institute, London, E.C.

Major General W. W. Richards, C.B., C.B.E., M.C., Chairman, presided. The following is an extract from his statement circulated with the Report and Accounts for the year ended December 31, 1954:—

Satisfactory progress was maintained throughout the year under review. Revenue at £328,993 showed an increase of approximately £10,000 compared with the previous year. Our tin was sold at an average price of £723 per ton metal, against an average of £664 for last year.

The profit for the year, after taxation, was £26,453, out of which the directors propose the payment of a dividend of 20%, less tax—the same as last year. This will leave a balance of £40,707 carried forward on Profit and Loss Account.

The output of tin was 610 tons averaging 74.5 per cent. metal, which is a decrease of 36 tons compared with last year.

We have to record some disappointment with regard to the Monighan Dragline. Arrangements have been made for an engineer from the manufacturers to supervise the installation of the replacements now in transit to the property, and we hope to have the machine working within the next few months. A proposal to electrify the driving unit is under urgent consideration.

The machine should prove a satisfactory low cost producing unit as soon as the modifications have been effected. Estimated production from this Dragline unit is upwards of 230 tons of tin per annum, and this should considerably augment the profit earning capacity of the company.

The ore reserves on the Tenti area, upon which the machine will work initially, are calculated at a minimum of 3,000 tons of tin contained in 9,000,000 yards proved suitable for dragline operations.

The ore reserve position remains satisfactory and at 5,090 tons is only 69 tons less than the figure as at the end of 1953. Prospecting continues as required.

Production for the first half of the current year is 299 tons, compared with 325 tons for the same period last year and the average price per ton metal has been about the same. If, as is expected, the Dragline comes into operation shortly production will automatically be raised.

The Report and Accounts were adopted.

INDIAN COPPER CORPORATION LIMITED

CHAIRMAN'S ADDRESS

The adjourned Thirty-first Annual General Meeting of the Corporation was held at the Royal Exchange Hall, Calcutta, on August 31. **Mr. K. R. Fettes, C.A.**, the Chairman, presided.

The following is his circulated address :—

Accounts.—As you will observe from the Profit and Loss Account, the Corporation has had a very satisfactory year, the result achieved being a record in the Corporation's history. This has been due to the consistently high world price of copper throughout the year and also, to a certain extent, to reduced development expenditure and an improvement in the standard of production of rolled sheets.

The profit for the year, before providing for taxation, depreciation and reserves, amounted to £898,382 as compared with £410,982 in 1953 when, as you will remember, results were seriously affected by a prolonged strike. The provision for taxation at £264,395 is lower than would normally be payable on such profits, the reason being that during the year we successfully fought an appeal in respect of the 1952/53 assessment which resulted in a refund of over £73,000.

Full provision has been made for Depreciation and it has also been deemed prudent to set aside £120,000 to cover the accrued liability of the Corporation for retirement gratuities which will be payable to workers under the new labour legislation and also the initial cost of a superannuation scheme for the staff, which your Directors consider to be essential in the best interests of the Corporation.

£150,000 has been allocated to General Reserve as against £75,000 last year, because, although the liquid resources of the Corporation are at present in a very satisfactory state, further heavy capital expenditure will have to be incurred during the next few years in developing the mine and possibly in sinking a new shaft should the results of present exploration of new areas prove successful. It will interest you to know that the new Circular Shaft which has recently been completed cost £330,000.

After making these provisions there remains a sum of £263,987 to which has to be added £76,278 brought forward from last year, giving a total of £340,265. Out of this, your Directors are pleased to be able to recommend the payment of a Dividend of 15% and a Bonus of 10%, both free of Income Tax, absorbing £228,550, and leaving £111,715 to be carried forward to next year.

Results for the current year to date continue to be satisfactory as the world price of copper is still high, but it is unlikely that this price will be maintained indefinitely.

Copper Leases—Operating Results.—A detailed review of the year's operations is given in your General Manager's Report, which can be seen during office hours at the Company's Head Office. Production and despatches were satisfactory, and operating costs were reduced due to lower development expenditure and to increased efficiency in sheet production.

Development.—As in the previous year lateral development has been restricted, but development in depth continues.

Ore Reserves.—Although the estimated reserves now stand at 3,369,286 short tons as compared with 3,416,570 at the end of the previous year, this is not considered unsatisfactory in the circumstances. It is not expected that Ore Reserve tonnages can be increased until the development in depth has made sufficient progress to allow for the opening up of points of attack so that fresh lateral development may be started.

Sales.—Although the price of copper fell after the re-opening of the London Metal Exchange in August, 1953, it recovered when the accumulated stocks in Chile were disposed of, and firmed still further as a result of prolonged strikes in Chile and other copper-mining countries. The demand for brass sheets, however, slackened, and we were unable to dispose of our full production. The average selling prices of the Company's products during the year were as follows :—

Copper Ingots	£233 per ton
Rolled Brass	£230 „ „
Y. M. Circles	£241 „ „
Rolled Copper	£288 „ „

Kyanite.—During the year Government relaxed the restriction on the export of this ore so that shipments improved by 3,300 tons. The average export price was again approximately £20 per ton.

Labour.—The rivalry between the two Unions at the Mines and the Works continues, but there have only been departmental strikes of short duration during the year.

Taxation.—In my address last year I referred to the preferential tax treatment granted to non-bedded mining companies in other countries, and expressed the hope that as a result of the case submitted to the Taxation Enquiry Commission they would recommend that similar allowances should be granted in India. From their report it is clear that the Commission recognized that such mining companies are faced with risks and uncertainties which do not apply to normal industry. Their recommendations, however, if implemented, would not in our opinion be of very material advantage to the few companies already established, and would not give that incentive which is so necessary if the non-bedded mineral resources of the country are to be adequately developed.

Staff.—A very high standard of efficiency has again been maintained both at the Mines and the Works and our thanks are due to all members of the Staff for the excellent service they have rendered to the Corporation

Mining Matters

The Institution of Mining and Metallurgy—New address.—On and after Monday, September 5, the address of the Institution of Mining and Metallurgy will be 44 Portland Place, London, W.1. Telephone : Langham 3802-3-4.

The Atlas Diesel Company of Wembley, Middlesex, have moved their Bristol branch to larger premises at 47a Zetland Road, Bristol 6. Mr. W. J. Clarke is Branch Manager. Telephone : Bristol 45036/7.

Rapid Magnetic Machines of Birmingham wish to state that they have been the sole licensees for many years for the Crockett heavy media magnetic separators, and that they cooperate with Dings of the U.S.A. in this field. The company also state that they have no connection with any other concern purporting to manufacture "Crockett Type" separators.

The Mond Nickel Company have announced that after an interval of 15 years, the registered office of the company is once again Thames House, Millbank, London, S.W.1.

Obituary

SIR DOUGAL O. MALCOLM, K.C.M.G.

Sir Dougal Orme Malcolm, president of the British South Africa Company since 1937, died in London on August 30, a few weeks following his 78th birthday.

Born on August 6, 1877, he was a leading authority on South African affairs, having devoted himself mainly to the several development projects which the late Cecil Rhodes inaugurated in 1889. Sir Dougal became a director of the British South Africa Company in 1912, and President of The Chartered Company in 1937. He was also chairman of the Northern Rhodesia Power Corporation, and the Rhodesia Railways Trust, whilst included amongst his directorships was De Beers Consolidated and the Standard Bank of South Africa.

GAMBIAN MINERALS LIMITED

(a subsidiary of British Titan Products Company, Ltd.)

requires for a new mining project in The Gambia still at the construction stage, an

ASSISTANT MINING ENGINEER/SHIFT BOSS to assist initially in the construction and lay out of a surface mine using excavating equipment and later act as a Shift Boss during operations.

A MILLING ASSISTANT/SHIFT BOSS to assist initially in the construction of a Dry Mill using electrical mineral dressing equipment and later act as Shift Boss during operations.

For both of the above posts about four years' field experience is required. Candidates should be about 25-30 years of age and graduates of recognized mining schools. Salary range £1,000-£1,500 depending on age and/or experience.

Free furnished accommodation and medical services are available. 18 month's tours followed by 4 months' home leaves. Wife's and children's allowances. Free passages out and back each tour with initial kit allowance. There is a Staff Superannuation Scheme and non-contributory Life Assurance Scheme.

Application Forms may be obtained from the Personnel Manager, British Titan Products Company, Limited, Coppergate, York, quoting reference S. 18. J.

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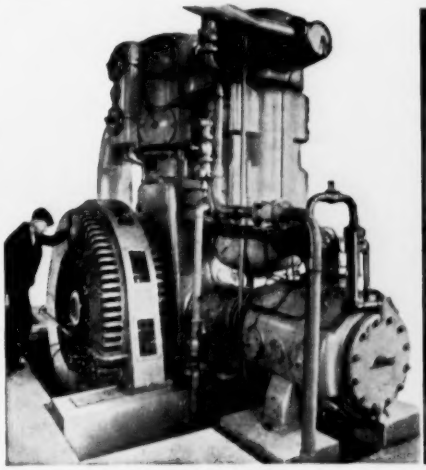
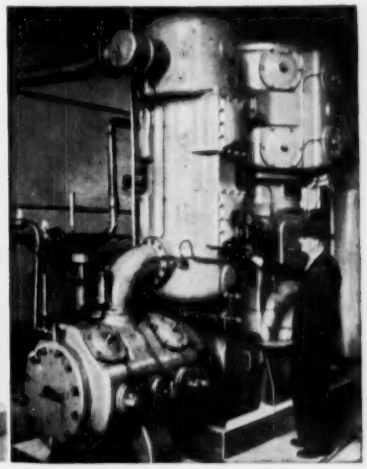




An Atlas Copco AR9 Compressor installed at N.C.B. Mountain Colliery, S. Wales

The photographs in this advertisement are published with the permission of the National Coal Board

FUEL SAVING PAYS FOR OUTLAY

To get the same amount of air from other compressors would, in most instances, require an additional 15 h.p., but 15 h.p. never used mean an *annual saving on fuel bills of £270.* That amount of money represents approximately *one-fifth* of the initial cost of the AR 3. In five years, that's your money back!

FLEXIBLE AIR SUPPLY

Three-step valve unloading control on smaller models or five-step clearance pocket control on larger sizes permits flexible adaptation to variations in air demand. Also means smooth flow of current to motor.

LOW DISCHARGE TEMPERATURES

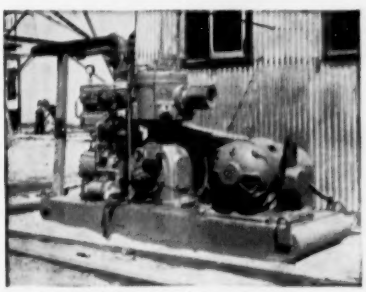
Amply-dimensioned water pockets, the two-stage design and streamlined air passages give discharge temperatures below 270° F at 100 lbs. per sq. in.—as compared with 475° F from most single-stage machines. Lower temperatures mean longer valve life and elimination of the risk of air receiver and pipe-line explosions.

EXTRA-SOLID CONSTRUCTION

High-class Swedish materials and steel throughout; amply-dimensioned parts reduce stresses to a minimum; crankshafts carried on SKF roller bearings; cross-head design with ground or white-metal lined bearings avoids piston side pressure, eliminates cylinder wear.

EASE OF INSTALLATION

Right-angled, double-acting cylinders combined with counterweighted crankshaft provide a very low weight/capacity ratio and extremely good balancing—thus reducing foundation requirements. So good indeed, that most models can be mounted on a skid underframe and used as semi-portable units without any foundation or bolting-down.



A skid-mounted Atlas Copco AR Compressor in operation at Pima Mining Co., Arizona, U.S.A.

Atlas Copco Compressed Air Equipment is manufactured or sold and serviced in 48 countries throughout the world by *The Atlas Copco Group*, which embraces companies trading under various names such as Atlas, Atlas Diesel, Atlas Polar, Atlas Copco, Copco, Delfos and Sampa.

MAIL THIS COUPON *to the most convenient of the addresses given here.*

UNITED KINGDOM, The Atlas Diesel Co. Ltd., Wembley, Middx.; FRANCE, Atlas Polar S.A., 29, Rue Marbeuf, Paris 8e; HOLLAND, N.V. Holland-Atlas, P.O. Box 6056, Rotterdam; ITALY, S.A.M.P.A., Viale Marche 15, Milan.
CANADA, Canadian Copco Ltd., Montreal, A.M.F.; AUSTRALIA, Australian Atlas Co. Pty. Ltd., P.O. Box 54, Auburn, N.S.W.; SOUTH AFRICA, Delfos Pty. Ltd., P.O. Box 504, Benoni, Transvaal.
U.S.A., Copco Pacific, Ltd., 930 Brittan Avenue, San Carlos, California; Copco Eastern, Ltd., PO Box 2568, Paterson 2, N.J.
Readers in countries outside those listed above and who do not know the name and address of their local Atlas Copco company or agent, please write, in the first instance, to AB Atlas Diesel, Stockholm 1, Sweden.

Please forward details of **Atlas Copco AR type Compressors.**

NAME _____

COMPANY _____

ADDRESS _____

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*I am also interested in other Atlas Copco equipment (please state which below).

_____ 3/22

PERFORMANCE FIGURES OF ATLAS COPCO AR COMPRESSORS

Type	Maximum pressure lb./sq. in.	Speed at 50 cycles r.p.m.	Low-pressure piston displacement cu. ft./min.	Free air delivery at 100 lbs./sq. in. cu. ft./min.	Power required at 100 lbs./sq. in. h.p.	Cooling water required at 60° F approx. gal./hr.	Weight lbs.
AR 1	120	600	404	330	62	310	2860
AR 3	120	500	718	570	105	506	5280
AR 4	120	429	915	760	138	682	5610
AR 5	120	375	1230	1000	185	880	9020
AR 7	120	333	2120	1750	320	1540	14520
AR 9	120	300	4020	3220	587	2926	26400

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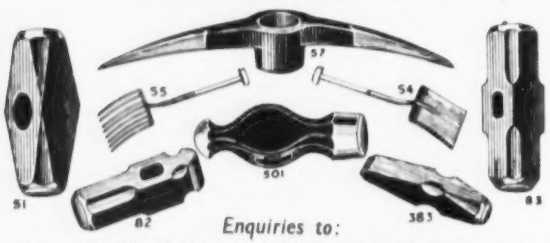

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(Dept. 93) 402, SALISBURY HOUSE, LONDON, E.C.2. **Telephone: NATional 0467**

CORRECT SOLUTION TO "UNICONE" CROSS-WORD No. 9 APPEARING ON PAGE 268

ACROSS: 1, Wallaby; 4, Flicker; 9, Animal; 10, Nepenthe; 11, Kiln; 13, Storehouse; 14, Saltpetre; 17, Green; 20, Rouge; 22, Heads; 23, Eponymous; 25, Specialise; 27, Nith; 29, Official; 30, Drover; 31, Kinsmen; 32, Cruelly.

DOWN: 1, Wrack; 2, Laminated; 3, Baluster; 5, Lopped; 6, Canto; 7, Roedean; 8, Incorruptible; 12, Irate; 15, Toe; 16, Ego; 18, Roman Nose; 19, Exult; 21, Engender; 22, Hassock; 24, Facile; 26, Cries; 28, Harry.

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